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ON
POISONS.

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MEMORANDA

ON

POISONS.

BY

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PREFACE.

THESE Memoranda are intended to refresh the memory of the practitioner on a subject which is not brought under his notice so frequently as many other departments of medicine. They are especially adapted to show at a glance the treatment to be adopted in each particular instance of poisoning to which a medical man is liable to be summoned.

There seems reason to fear that the crime of slow poisoning is more extensively practised in the present day than is generally believed. The study of the following pages will, it is hoped, put the physician on his guard; and prevent his attributing to natural disease, symptoms due to the villanous administration of deadly drugs.

Henrietta-street, Cavendish-square.
1st July, 1862.

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TOXICOLOGICAL MEMORANDA.

INTRODUCTION.

CHAPTER I.

DEFINITION AND MODE OF ACTION OF POISONS.

Toxicology (*τοξικὸν*, poison, and *λόγος*, discourse,) is that branch of medical science which treats of the nature, properties, and effects of poisons.

It appears scarcely possible to give any definition of a poison, which will bear a critical examination. Most medicines are poisonous in improper doses; and even common salt (chloride of sodium) has caused death.* Dr. Guy defines a poison to be any substance, which, when applied to the body externally, or in any way introduced into the system, without acting mechanically, but by its own inherent qualities, is capable of destroying life.

Any substance which can injure the health or destroy life is regarded as a poison, if given with the *intent* to do mischief. The words of the statute (1 Vict. c. 85,

* In the year 1839, a young lady residing in the north of England took about half a pound of salt to rid herself of worms. Very soon afterwards she began to suffer from all the effects of an irritant poison, with general paralysis; and in spite of the use of the stomach pump and of antidotes, she died in a few hours. *Dr. Christison* has recorded two somewhat similar cases.

sec. 2) are—"Whoever shall administer, or cause to be taken by any person, any poison, or other destructive thing, with intent to commit murder, shall be guilty of felony, and being convicted thereof, shall suffer death." Sometimes poisons are administered not for the purpose of destroying life, but of causing some slight injury or annoyance. An Act passed in March 1860 (23 Vict. c. 8) provides for the punishment of a prisoner under these circumstances. If life be endangered, or "grievous bodily harm" result, the administrator may be found guilty of felony, and sentenced to penal servitude for a time not exceeding ten years. If the intent be only to "injure, aggrieve, or annoy" the crime is reduced to a misdemeanour, punishable with an imprisonment for not more than three years.

Poisons may be introduced into the body in various ways; and they may be given in the form of powders, liquids, gases, and mixed with various matters. Some agents are more readily absorbed than others; and some textures permit of absorption taking place more quickly through them than other tissues. Thus, poisons prove most rapidly fatal when introduced directly into the circulation by a wound in a vein. Their action is also speedy, when applied either in a fluid or gaseous state to the mucous membrane of the pulmonary air-cells, or to that of the stomach or intestines. The serous membranes too, possess an activity of absorption, almost superior to that of the mucous membranes; while the cutaneous absorption is slow, on account of the cuticle. Poisons taken into the stomach when this viscus is empty, act much more speedily than when it is full; especially if the substance be given in solution. It is remarkable that the agents which most affect the nervous system, do not act at all when applied directly to the brain or trunks of nerves. There are also some poisons, as that of the viper (echidnine), which although *most deadly when introduced* into the blood through a *wound, are harmless* when swallowed.

The action of poisons may be considered as local and remote.

The *local* effects are of three kinds, viz. *corrosion*, or chemical decomposition, as is seen in the effects of the strong mineral acids and alkalies; *irritation*, or *inflammation*, varying from simple redness in its mildest, to ulceration and gangrene in its most severe degree; and *a sympathetic effect*, produced on the sentient extremities of the nerves, as is felt on the local application of prussic acid, &c.

The *remote* effects are those affecting an organ remote from the part to which the poison has been applied. Various narcotic poisons produce but little local change, though their remote effects are very remarkable. For example, belladonna, in whatever way it may be introduced into the system, paralyses the ciliary nerves and so causes dilatation of the pupil. Many substances have both a local and remote action, as is well seen in the influence of cantharides upon the part to which they are applied, and their remote effects upon the urinary organs.

These remote effects must be conveyed by one of two modes, or, as some contend, by both; by *absorption*, that is, by the passage of the poisonous particles into the blood, or by *sympathy*, that is, by an impression transmitted through the nerves.

In the present day every one allows that poisons become absorbed, and that they do so in whatever way they may be applied to the body. But it is sometimes asked,—Is this absorption necessary for their action? The following evidence may be briefly noticed as affording an affirmative answer to this question. Magendie divided all the parts of one of the posterior extremities of a dog, the artery and vein being reconnected by quills, so as to preclude the possibility of the effect being conveyed by the nervous filaments supplying the coats of the vessels; and on applying a portion of upas tieuté to a wound in the *foot, the symptoms* of poisoning occurred, and death took *place in ten minutes.* If the veins leading from a poisoned

part be tied, the arterial and nervous communication being complete, the symptoms of poisoning do not occur. Mr. Blake introduced some prussic acid into the stomach of a dog, through an opening in its parietes, after he had ligatured the vessels entering the liver (the vena portæ, formed by the union of the superior mesenteric and splenic veins, the latter of which receives the gastric veins). No effect ensued until the removal of the ligature, within one minute of which proceeding the poison began to act. And lastly, not only has prussic acid been discovered in the blood of an animal which perished in thirty-five seconds, but, in some experiments made by Mr. Erichsen, in a case of extroversion of the bladder, prussiate of potass was found in the urine within one minute of its being swallowed on an empty stomach.

The chief argument in favour of a *sympathetic* action, is the almost instantaneous manner in which some poisons act; occurring, it is said, before sufficient time has elapsed to allow of absorption. It has, however, been proved that the round of the circulation may be accomplished much more speedily than has been imagined. Thus, the ferrocyanide of potassium injected into the jugular vein of a horse was discovered throughout the entire venous system in twenty seconds; and Mr. Blake has inferred from his experiments that a poison may be diffused through the body in nine seconds. It may therefore be concluded that in all probability poisons act by being absorbed and conveyed with the blood to the different organs which they impair; some paralysing the heart when they reach it, some affecting the brain or the spinal cord, some stopping the play of the lungs, and others acting upon the different glands.

Opium, arsenic, and prussic acid seem to be the substances which are most frequently used as poisons in this country.—According to the Registrar-General's Twenty-second Annual Report there were 391 deaths by poison, *in England, in 1859*: viz.—279 said to be from accident,

and 112 from suicide.—Many cases of chronic poisoning have occurred within the last few years. In these, small doses of active poisons—such as arsenic, tartar emetic, &c.—have been artfully given for a long time, so that the resulting symptoms might appear to be owing to natural disease. It is to be feared that more instances of secret murder, due to this cause, have occurred, than have been detected.

The scope of this work will not permit of attention being paid to the literature of my subject. Otherwise, an interesting chapter might be compiled on the various treatises which have appeared since the first work on poisons was written 150 years B.C. by Nicander of Colophon, the Greek grammarian, poet, and physician. So again, it would not be difficult to engross the student's attention by treating of the fate of Socrates, who, according to Plato, was made to drink hemlock (about 400 B.C.), this being one of the Athenian modes of execution; of Demosthenes, who committed suicide by poison, 322 B.C.; of Hannibal, who terminated his existence in the same way, 182 B.C.; or of Cleopatra, Queen of Egypt, so celebrated for her beauty and intrigues, who, rather than fall into the hands of the conqueror Augustus, destroyed herself by the bite of an asp. In modern times much has been written on the science of toxicology which in the present day excites amusement. The relations between fear and credulity, however, are so intimate, that it is no wonder the action of poisons has been exaggerated; for engines so powerful and secret in their mode of destruction must always arouse the terrors of mankind. Yet no educated person now believes that the operation of poisons can be so predetermined as that they may prove fatal on a fixed day, or after the lapse of a definite and remote interval. With regard to those noted instances of Tofana and Brinvilliers, which occurred in Italy and France about the middle of the seventeenth *century, it is* certain that the actors in them owed their

success more to the ignorance and superstition of the age, than to their own dexterity.

CHAPTER II.

DIAGNOSIS OF POISONING.

THE chief characteristics of poisoning mentioned by authors of repute, are that the symptoms commence suddenly, after taking any substance or fluid into the stomach, the individual being in a state of health; that they increase steadily, and are uniform in their nature throughout their course; and that they prove rapidly fatal. There are many exceptions to these rules. Thus, if the stomach be loaded the appearance of the symptoms will often be delayed some few hours. Sleep, according to Dr. Christison, may retard the action of some agents; so that if a person fall asleep soon after swallowing arsenic or strychnia, for example, no effect may ensue for four or five hours. Intoxication will mask the effect of narcotics. Again, the individual poisoned may be suffering from disease, and an agent may be given which will only aggravate existing symptoms; or sometimes a poisonous draught is substituted for the harmless medicine. And lastly, after a poison has manifested its effects, the symptoms often remit for a time.

When poison is administered with a criminal intent, it is generally in such a dose as to take immediate effect; although this is by no means necessary, as there are numerous substances which accumulate in the system, and when given in small and repeated quantities, ultimately prove fatal. It must also be remembered that there are many diseases, as malignant cholera, internal *hæmorrhage, &c., which* commence suddenly, and rapidly *run to a fatal termination.* In inflammation of the

stomach or intestines the symptoms often set in suddenly, and might be mistaken; and such is also the case in intestinal obstruction, and especially in ulceration and perforation of the bowels. So also in organic diseases of the heart, where the symptoms may have remained latent for some time, death often occurs suddenly from syncope. The diagnosis of the effects of irritant poisons is not so difficult as it is in the case of narcotics or narcotico-irritants, where the symptoms are very similar to those produced by apoplexy, epilepsy, tetanus, convulsions, and disease of the brain.

Generally speaking, a person may be supposed to be poisoned, if after taking food or drink, he be seized with violent pain, vomiting, disorder of the alimentary canal, and convulsive movements: or if he be attacked under the same circumstances with vertigo, delirium, or great drowsiness. It must not be forgotten, however, that poisons may be introduced into the body by means of enemata, or in females by vaginal injections, or by inhalation, or through the true skin after the removal of the cuticle. Should death ensue, the presumption of unfair play will of course be strengthened by the discovery of post-mortem appearances similar to those known to be produced by the poison from which the person apparently suffered.

The post-mortem appearances, however, except in a few instances, are by no means to be relied upon; and the two symptoms, excessive lividity of the body, and early putrefaction, formerly supposed to indicate death by poison, are now known to be as frequently produced by natural disease. It may nevertheless be generally remarked, that the appearances after death, which may be produced by poisons, are in one great class, the signs of inflammation of the alimentary canal; in another, the signs of congestion of the brain; and in a third, a combination of the two.

The detection of poison in some of the food which has *been taken,* or in the matters vomited, would seem to

be conclusive evidence; but it is to be recollected that designing persons have mixed noxious materials with food or rejected matters, in order to feign poisoning, or to cast unjust imputations upon others.

When a practitioner is called to a case where death is supposed to have resulted from poison, he ought to make written notes of his observations. He should inquire the time at which any substance was last taken, the nature of the symptoms and the hour at which they commenced, and the precise time at which death occurred. He must take possession of any food, medicine, vomited matters, urine, or fæces which may be in the room; and, if possible, he is to seal them up, in clean vessels, duly labelled, for examination. Any *voluntary* explanation by the attendants is to be noted. Then the position and temperature of the body are to be observed, the appearance of the countenance, the presence or absence of rigor mortis, with the nature and warmth of the apartment, the situation of any marks of violence, and the condition of the inside of the mouth and gullet. If the examination is to be carried further, as it ought to be, the œsophagus and stomach, with the contents, must be carefully removed for analysis: the contents of the duodenum are to be taken in a separate clean vessel: the mucous lining of the intestines is to be carefully looked to, particularly that of the rectum: and, in women, the vagina, uterus and ovaries must be inspected. The brain, spinal cord, and thoracic viscera ought likewise to be examined: and a portion of the blood, liver, spleen, kidneys, and muscles should be reserved for analysis. No antiseptic or preservative fluid is to be used. When possible it will be better to make the autopsy within twenty-four hours after death; taking care to do so patiently, thoroughly, and free from any bias. Poison may be found in a body, and yet a question may arise as to its having been the cause of death. *Hence in these investigations* every organ of the body is

to be examined, in order to learn whether any disease has existed sufficient to account for the fatal result.

If proof can be given that a person has died from the administration of a poison, it is not necessary that the poison be detected by chemical analysis to insure the conviction of the party guilty of giving it. Setting aside the fact that the poison may have been expelled from the system by excessive vomiting or purging, or that it may have been eliminated by the kidneys, or that it may have been decomposed in the body, the substance may be one that in the present state of science chemists are unable to detect in the tissues. This is especially the case with many vegetable matters, and with the powerful alkaloids extracted from them. It is in such instances, more particularly, that experiments on animals are sometimes made; though care must be taken not to place too much reliance upon the results. Dogs, cats, guinea-pigs, mice, and frogs are the animals usually selected for trial; and the experiments may be made with the suspected articles of food or drink, or with the matters vomited, or with the flesh of poisoned animals. In drawing up a medico-legal report the observations must be made under three heads,—the symptoms during life, appearances after death, and the chemical analysis. The exact time and date is to be given, the simplest language is to be used, and the report is to end with the conclusions drawn from the facts. The practitioner must remember that he will probably have to appear in the witness-box, when every expression he has adopted may be roughly criticised. Let him recollect, too, that he is merely a skilled witness—a calm, truthful interpreter of scientific facts. As he is neither a judge nor an advocate, so he must curb his imagination; and especially should he beware of straining the data afforded by his investigations in order to serve any particular object.

CHAPTER III.

TREATMENT OF POISONING.

In the treatment of a case of poisoning, the object of the physician may be comprised under three heads, viz. —1st. To promote the discharge of the poison from the system. 2nd. To counteract its operation by means of antidotes. And 3rd. To remedy the effects produced, and obviate the tendency to death.

1st. *To Promote the Discharge of the Poison from the System.*

a. When taken into the stomach. This may be fulfilled in two ways, either by the stomach-pump, or by emetics. The former is one of the most certain means we possess of emptying the stomach; and by means of it this viscus is washed out, and the antidote—if any be known—administered. In speaking hereafter, however, of the treatment to be adopted in each particular instance, it will be seen that there are some cases (poisoning by the corrosives) in which this instrument cannot be used; as it might not only cause laceration of the tissues, but even perforation of the œsophagus or stomach. It is hardly necessary to mention that in all cases a certain tact is required in its employment; the tube having, on more than one occasion, been introduced into the trachea, and the lungs injected with water, &c. It is a good rule also to withdraw less fluid than is pumped into the stomach. Supposing, however, that this instrument is not at hand, or that it is an improper occasion for its employment, recourse must be had to emetics, (unless the poison itself has produced sufficient vomiting). Of these remedies perhaps there is not one which can be generally used with so much advantage, as the sulphate of zinc in scruple doses; for not only is it more rapid in its action, but its effects are less depressing than those of any others. This last recommendation will appear

the more desirable, when we remember that the absorption of poisons is promoted by all lowering measures; and consequently, bleeding, the exhibition of tartarized antimony, and the administration of drastic purgatives ought to be avoided. In poisoning by opium and other narcotics, the sulphate of copper in eight or ten grain doses, will often excite the stomach to act, when other emetics have failed. The ipecacuanha wine (six or eight drachms) is a useful agent; or if a warm stimulating draught be needed a scruple of powdered ipecacuanha, with the same quantity of the sesquicarbonate of ammonia, may be administered in a wineglassful of water. In the absence of these, mustard proves an excellent substitute; a teaspoonful or two being given in warm water, and frequently repeated. Vomiting should also be excited by tickling the fauces; as well as by the free administration of warm water, or of hot greasy water.

β. When applied locally. To prevent the absorption of the poison in these instances, a ligature must be applied between the trunk and wounded part, as near the latter as possible; while the deleterious substance is to be removed by exhausting the air over the part by cupping-glasses, &c.

2nd. *To counteract the Operation of the Poison by Antidotes.*—As no universal antidote is known, the treatment will of course vary with the substance taken. This will be fully explained when speaking of each particular poison.

An antidote, according to Orfila, should possess the following properties:—It should be taken in a large dose without danger; it should act upon the poison, whether liquid or solid, at a temperature equal to or below that of the body; its action should be quick; it should be capable of combining with the poison, though shielded by the gastric juice, mucus, bile, or other substances contained in the stomach; and lastly, it should deprive *the poison of its* deleterious properties.

Antidotes operate by forming harmless chemical combi-

nations, or by producing insoluble compounds, and thus preventing or delaying absorption. It must be remembered, that they have no effect upon the constitution, and that their efficacy will therefore depend upon their being used early.

Dr. Garrod has described a series of experiments in which he employed purified animal charcoal as an antidote. This substance is prepared from ivory-black, by digesting it in dilute hydrochloric acid to remove the earthy matters, washing, and then heating it to redness in a covered crucible. Dogs, rabbits, and guinea-pigs were the animals experimented on; while the poisons consisted of large doses of opium, belladonna, aconite, nux vomica, arsenic, and other drugs. They were given without mischief when sufficient animal charcoal was administered simultaneously, or, in some instances, before the peculiar effects of the destructive drug were developed. Dr. Garrod believes that the charcoal has the power of combining in the stomach with the poisonous principles of animal and vegetable substances, so as to produce innoxious substances: that when given in large quantities it will absorb some mineral substances (especially arsenic) and render them inert: that about half an ounce of charcoal is required to each grain of morphia, strychnia, or any other alkaloid; but much less for the drugs from which they are obtained, a scruple of nux vomica, for example, not requiring more than half an ounce of charcoal: and lastly, the antidote has no injurious action on the body.

3rd. To Remedy the Effects produced, and Obviate the Tendency to Death.—Unfortunately, in a great number of instances, too long an interval has elapsed between the exhibition of the poison and the time when the first-mentioned indications can be fully carried into effect; for, as before inferred, if absorption has taken place, direct antidotes will be of little avail.

Our object must then be to palliate the symptoms, as *well as to neutralize the effects*, by remedies of an oppo-

site character. Thus in poisoning by depressing agents and narcotics, or such as destroy the nervous force, all lowering measures must be avoided, and agents used which will exert a contrary effect, as stimulants, cold affusion, galvanism, &c. The shock to the nervous system must also be taken into account, and appropriate remedies employed to aid it in rallying.

Claude Bernard has shown the importance of particularly attending to the way in which the poison destroys life. For example, woorara paralyses the motor nerves, puts a stop to all motion, suspends respiration, and so brings on suffocation: yet by keeping up artificial respiration for a sufficient length of time, life may be preserved till the poison is eliminated, and the danger over. Strychnia attacks the sensitive portion of the nervous system; but if the external excitement which perpetually provokes reflex action, and thereby brings on fatal convulsions, be guarded against, recovery may ensue. A frog, poisoned by strychnia, rapidly dies if frequently excited; whereas left perfectly quiet under a glass bell, it will, cæteris paribus, recover.

Lastly, we must endeavour to promote the elimination of the poison from the body, by exciting the excreting functions; for which purpose in poisoning by arsenic, after the stomach has been well emptied, Orfila has proposed the employment of diuretics, because it has been found that this poison is carried off in large quantities by the urine.

CHAPTER IV.

CLASSIFICATION OF POISONS.

Poisons may be conveniently arranged according to their *mode* of action, into three classes,—*Irritants*, *Narcotics*, and *Narcotico-Irritants*.

The following table exhibits the subdivisions of these classes, and the poisons contained in each.

- **I.—Irritants.**
  - Acids and their Bases
    - Mineral Acids
      - Sulphuric.
      - Nitric.
      - Hydrochloric.
      - Mixed Acids.
    - Vegetable Acids
      - Acetic.
      - Tartaric.
      - Oxalic.
    - Phosphorus.
    - Iodine.
  - Alkalies and Alkaline Salts
    - Ammonia, Potash, Soda, and their carbonates.
    - Nitrate, Sulphate, and Bitartrate of Potash.
    - Lime, Baryta and its salts.
  - Metallic Compounds.
    - Arsenic.
    - Mercury.
    - Lead.
    - Copper.
    - Antimonial compounds.
    - Zinc, Silver, Tin, Bismuth, Chrome, Iron.
  - Vegetable and Animal Irritants.
  - Irritant Gases.
- **II.—Narcotics.**
  - Opium.
  - Hydrocyanic Acid.
  - Chloroform, Æther, Amylene.
  - Alcohol.
  - Henbane, Lettuce-opium, Nightshade.
  - Narcotic Gases.
- **III.—Narcotico-Irritants.**
  - Nux vomica, Brucia, Strychnia.
  - Belladonna, Aconite, Stramonium, Colchicum, Hellebore.
  - Digitalis, Tobacco, Lobelia Inflata, Camphor.
  - Hemlock, Cocculus Indicus, Darnel seeds.
  - Laburnum, Yew.
  - Ergot of Rye, Poisonous Fungi.

Irritant poisons give rise to pain in the stomach and *bowels, sickness, and purging* with tenesmus. *evacuations are often tinged* with blood, the puls

feeble and irregular, and the skin cold. Many of the substances of this class also corrode the tissues with which they come in contact, and hence they produce a severe burning sensation in the mouth, œsophagus, and stomach. The degree of chemical action produced will of course vary in proportion to the amount of water with which the noxious agent may be diluted. They cause death by inducing collapse, or convulsions; or by exciting severe inflammation; or, after a variable interval, by leading to stricture of the œsophagus. The diseases which most resemble the action of the irritants are,—malignant cholera, severe diarrhœa, colic, gastritis, enteritis, rupture of the stomach or intestines, and obstruction of the bowels.

Narcotics act on the brain and spinal cord, inducing headache, drowsiness, giddiness, stupor, and insensibility. Frequently there are convulsions, and sometimes paralysis. There is very seldom vomiting or diarrhœa. The symptoms of apoplexy, epilepsy, and uræmia bear a resemblance to those caused by poisons of this class.

Narcotico-Irritants produce great thirst, pain in the throat and stomach, vomiting and purging, delirium with spectral illusions, and rarely convulsions. Sometimes there is tetanus, sometimes coma or syncope. Diseases of the brain and spinal cord are often very insidious in their progress, and hence may suddenly give rise to suspicious symptoms. The history, mode of attack &c. will generally negative any suspicion of poisoning.

Dr. Taylor's classification is into Irritants and Narcotics; the latter class being made up of the narcotics and narcotico-irritants. The narcotics are further divided into cerebral, spinal, and cerebro spinal poisons; according as the substance affects the brain, spinal cord, or both these organs.

I.—IRRITANT POISONS.

CHAPTER V.

MINERAL ACIDS.

THE first division of the Irritants consists of the Acids and their Bases. In this chapter we have to review the effects, &c. of the mineral acids.

SULPHURIC ACID (*Oil of Vitriol*).—This heavy, oily-looking liquid is met with in two states, concentrated and diluted; and being extensively employed in commerce, is much more frequently used as a poison than the other mineral acids. Many infants and young children have been poisoned by it. The acid is not unfrequently thrown over the person; either to disfigure the features, or to destroy the clothes. The parts with which it is brought into contact are stained at first of a white, and afterwards of a dark brown colour. All the acids redden vegetable blues. The smallest fatal dose of concentrated acid recorded, in the adult, is one drachm: but recovery has taken place after as much as two ounces. The average period at which death occurs is from sixteen to twenty-four hours.

Tests.—It is not within the province of these Memoranda to treat of the various tests by which poisons are to be detected; for I hold that to perform a trustworthy analysis requires the skill of a professed chemist, whose *assistance should be* allowed in these medico-legal investigations. *Where* the character of a dead man, or

the life of a supposed criminal is at stake, there must be no chance of error. When, however, certain simple tests will enable the practitioner to learn whether a poison has been used, and if so its nature, then they will be briefly described; if only to help the physician to treat the case more satisfactorily than he could do by merely guessing that an irritant or narcotic had been employed.

The concentrated sulphuric acid is a brownish-coloured liquid; which chars or corrodes wood or other organic matter brought into contact with it, and when mixed with water gives out heat. When diluted, its presence may be thus detected:—the liquid is known to be acid by its action on litmus paper. Add to a portion of it a few drops of nitric acid, and then a solution of nitrate of baryta,—a white precipitate (sulphate of baryta) will fall if sulphuric acid be present. This test is extremely delicate; for although other acids yield a precipitate on the addition of nitrate of baryta, yet as such deposits are all soluble in nitric acid, the previous addition of this acid will prevent their formation. To examine a piece of cloth stained with this poison it is only necessary to boil it in distilled water and then apply the baryta test.

Nitric Acid (*Aqua fortis, Red Spirit of Nitre*).—This substance has been employed as a poison for upwards of four centuries. Like the oil of vitriol it is used in a concentrated or diluted state. Cases of poisoning by it are rare. It produces a yellow stain. Two drachms is the smallest quantity which has destroyed life; but less than this would probably prove fatal, if it produced much corrosion. Death has occurred from it, in one hour and three quarters; the average would be within twenty-four hours.

Tests.—The concentrated acid may be known by the odour of its vapour, by its orange-coloured irritating fumes, and by its action on copper, tin, or mercury. *When added to* a few copper-filings, effervescence takes *place,* a red acid vapour is given off, and a green liquid

remains (solution of nitrate of copper). In a diluted state it is detected by its acid re-action; by no precipitate being obtained by nitrate of baryta, or by nitrate of silver, proving the absence of sulphuric and hydrochloric acids; and by neutralizing the liquid with potash, evaporating it, and procuring crystals of nitrate of potash, in the form of lengthened fluted prisms, which are permanent in the air. Further, these crystals may be powdered and moistened with strong sulphuric acid, when a colourless acid vapour will be evolved. Or the powdered crystals may be mixed with an equal bulk of fine copper filings, moistened with water, and treated with a few drops of sulphuric acid; when red, acid fumes of nitrous acid will be given off.

HYDROCHLORIC ACID (*Muriatic Acid, Spirit of Salt*).—Not more than half a dozen cases of poisoning by this acid have occurred in the last six or eight years in this country. In May 1859, a woman, sixty-three years old, was admitted into King's College Hospital within three-quarters of an hour of swallowing half an ounce of the strong acid. She had burning pain in the throat and stomach, vomiting of brown shreddy matters, and great prostration. Death occurred in eighteen hours from the corrosive action of the poison. This is the smallest dose which has been known to prove fatal.

Tests.—The concentrated acid of commerce is of a yellowish colour, it fumes in the air when strong, and it gives a dense white fume with the vapour of ammonia. It may be identified by boiling with black oxide of manganese; chlorine being given off, which is known by its odour, colour, and bleaching properties. When diluted, its presence is ascertained by nitrate of silver causing a dense white precipitate (chloride of silver.) The chloride is distinguished from other salts of silver by its insolubility in nitric acid, and in caustic potash; by its being soluble in ammonia; and by its melting like a resin when dried and heated.

MIXED ACIDS.—These acids being used for commercial

purposes when mixed,—*the nitro-muriatic* (aqua regia) to dissolve gold, and the *nitro-sulphuric* (aqua reginæ) to dissolve silver, might give rise to their being employed as poisons. *Sulphate of Indigo*, which consists of a solution of indigo in sulphuric acid, has proved fatal in cases where it has been accidentally taken.

SYMPTOMS, TREATMENT, &c.—The *symptoms* produced by the mineral acids are much the same in all cases. There is a violent, burning pain in the mouth, œsophagus, and stomach, commencing immediately. The burning is followed by retching and vomiting of a dark-coloured liquid with shreds of mucus, and portions of the mucous membrane of the œsophagus or stomach. The inside of the mouth is shrivelled and more or less corroded, unless the agent has been given in a spoon passed over the tongue to the back of the fauces. There is great thirst, difficulty of swallowing, and impeded respiration. Then succeeds great exhaustion, the pulse becomes quick and feeble, and the skin gets cold and clammy. The countenance is anxious and expressive of great suffering; and death speedily occurs, the intellectual faculties remaining clear to the last.

These acids may prove fatal without entering the stomach by causing asphyxia, the chink of the glottis becoming closed by the swelling of the fauces, &c. They have also been administered by the vagina, rectum, &c., and been poured into the ear during sleep.

Where recovery takes place from the immediate effects there is always fear of death resulting at the end of one or two years from the stricture of the œsophagus, and even at an earlier period unless proper treatment is adopted. Occasionally one of the secondary effects of sulphuric acid has been profuse salivation.

The *post-mortem appearances* are the following: The body has a healthy appearance, but is stained about the mouth, fingers, and wherever the cuticle has been disorganized by the acid. The inner surface of the mouth, fauces, and œsophagus, is usually white and corroded,

the mucous coat being easily detached. The outer surface of the stomach and intestines is very vascular, that of the former being corroded and occasionally perforated. The stomach is sometimes contracted—sometimes distended with gas, and contains a thick, dark brown fluid; its inner surface has a charred, blackened appearance, the mucous membrane between the rugæ being of a scarlet hue. The pylorus is mostly contracted; while the inner coat of the duodenum and small intestines presents a similar appearance, in a less degree, to that of the stomach.

According to Casper, after poisoning by sulphuric acid, the bodies resist putrefaction for some time, owing perhaps to the acid neutralising the ammonia of decomposition. It may be the same with the other mineral acids.

Treatment.—Carbonate of soda, or calcined magnesia, or the carbonate of magnesia, should be immediately given, mixed in milk or any mucilaginous fluid; the doses being continued at short intervals, until it may be inferred that the acid is neutralized. In the absence of these remedies substitutes may be found in chalk, whiting, soap and water, or the plaster of the apartment beaten up with water. Oleaginous and mucilaginous fluids, as olive oil, linseed tea, barley water, milk, gruel, &c., may be freely given, either alone, or as the vehicles of the antidote. The success of this treatment will depend upon the promptitude with which it is adopted.

Sometimes the patient is unable to swallow, when it is recommended to employ the stomach-pump to inject these antidotes. This, however, ought to be a last resource, on account of the imminent danger of causing laceration.

Should the larynx be injured, and the breathing impeded, tracheotomy must be at once had recourse to.

After a sufficiency of the antidote has been given, the use of *mucilaginous* diluents must be continued for some

time, and the subsequent treatment will be that for gastro-enteritis. Great benefit will be derived from the use of oily enemata.

The external parts which have been injured by the acid, should be well bathed with soap and water.

CHAPTER VI.

VEGETABLE ACIDS.

ACETIC ACID.—Although this acid in its concentrated state is an irritant and corrosive, yet it is very seldom brought under the notice of the toxicologist.

Vinegar may be obtained from any fluid which is capable of undergoing vinous fermentation. In this country it is usually procured from an infusion of malt and raw barley : it contains about five per cent of acetic acid, and one part in a thousand of sulphuric acid. The milk of a wet-nurse who consumed vinegar of roses very freely was found thin, acid, and deficient in casein ; while her infant wasted and died.

The *symptoms* produced by the strong acetic acid are a sense of burning in the stomach, with severe pain, and a feeling of sickness. In the case of a young woman reported by Orfila, death quickly occurred after several attacks of convulsions. At the subsequent post-mortem examination, the integuments of the dependent parts of the body were found very livid ; the tongue and œsophagus were of a dirty brown colour, the latter being intersected by a fine net-work of capillary vessels ; and the interior of the stomach was interspersed with black elevations caused by the presence of coagulated blood in the sub-mucous areolar tissue. The mucous membrane *was entire.*

As regards the *treatment* it is only necessary to ab-

minister draughts containing magnesia or its carbonate, followed by mucilaginous or demulcent drinks.

TARTARIC ACID.—Strange as it may seem tartaric acid has destroyed life in at least one instance in this country; an ounce having been given in mistake for an aperient salt. The symptoms were those of an irritant poison. Soda and magnesia were administered without avail; and after death, at the end of nine days' suffering, the stomach and intestines were found much inflamed.

OXALIC ACID *(Acid of Sugar.)*—This is one of the most important poisons. From its cheapness and well known properties it is frequently made use of in cases of suicide; while from its resemblance to Epsom salts, it has on several occasions been taken in mistake for that medicine. The smallest dose which is known to have proved fatal is one drachm, which killed a boy æt. sixteen, in eight hours. Taylor relates the case of a woman, aged twenty-eight, who was found dead one hour after swallowing three drachms of the crystallized acid. Christison mentions an instance in which one ounce destroyed life in ten minutes, and another case where the same quantity killed a girl in thirty minutes. One example has been recorded where a fatal result ensued probably within three minutes of the acid being swallowed.

The poisonous properties of the *Binoxalate of Potash* (Salt of Sorrel, Essential Salt of Lemons) are due to the oxalic acid it contains. This salt, which abounds in the leaves of the wood sorrel (Oxalis acetosella), is sold to bleach straw, remove ink-stains, &c. It is very cheap; is almost as powerful as oxalic acid itself, and gives rise to the same kind of symptoms; and has been taken for the purpose of suicide, as well as in mistake for the bitartrate of potash, or cream of tartar.

Oxalate of lime exists in large quantity in the leaves and stalks of the common edible rhubarb (Rheum Rhaponticum). It is said that the free consumption of this *plant has more than* once produced symptoms of intestinal *irritation and even gastritis.*

Symptoms.—The effects of poisoning by oxalic acid are peculiar. When the dose is large (half an ounce or more,) and the solution concentrated, it proves rapidly fatal; producing a hot acid taste in the fauces and œsophagus, severe burning pain in the stomach, and in most instances vomiting. The vomited matters are strongly acid, of a dirty green or black colour, and consist of the contents of the stomach with altered mucus and blood. The remaining symptoms are a sense of constriction or suffocation, lividity of the countenance, great prostration of strength, feeble pulse, cold clammy perspirations, and convulsions which speedily terminate in death. When a smaller quantity is taken much diluted, its corrosive properties are weakened or destroyed; and it proves fatal by acting indirectly on the heart, brain, or spinal marrow. In such instances it either paralyses the heart, or produces coma, or induces tetanic spasms of the respiratory muscles. Thus it would appear, as observed by Christison, that when not taken in sufficient quantity to cause death by the local injury produced, it acts by absorption; although chemists have failed in detecting it in the blood.

In cases of recovery the mouth may remain sore for some time, the tongue swollen, the abdomen tender, the stomach very irritable, and there may be troublesome diarrhœa. In two instances there has been a loss of voice for several days, owing to the action of the poison on the nervous system. Twitching of the muscles of the face and extremities has also been observed.

Post-mortem Appearances.—These are not always so distinct as might be imagined; in some fatal cases the whole intestinal tract having been found apparently healthy. The mucous membrane of the fauces, œsophagus, and stomach is generally white and brittle; the coats of the latter organ being seldom or never perforated. The stomach often contains a black fluid, like coffee-grounds, consisting principally of blood; and its sub-mucous coats *are vascular* and dark coloured. If death has occurred *quickly, the* small intestines are seldom much affected;

but where the symptoms have been protracted, there have been found signs of congestion and inflammation.

Treatment.—Chalk, whiting, or magnesia, suspended in water, or in some demulcent fluid, must be administered immediately; and, if necessary, vomiting should be excited by tickling the fauces, or administering emetics of sulphate of zinc, &c., followed by large quantities of emollient drinks. The antidote, to be effective, must be given as soon as possible, the plaster of the apartment being used in the absence of the remedies just mentioned. Alkalies (soda, potash, or their carbonates) are not only useless, but they form salts with oxalic acid, which are as injurious as the acid itself. Where there are symptoms of collapse, stimulants are to be freely employed.

Tests.—Crystals of oxalic acid are met with as four-sided prisms, colourless, without odour, permanent in the air, and very acid; this last character distinguishing them from crystals of sulphate of magnesia and sulphate of zinc. They are soluble in from eight to twelve parts of cold water. This acid may be thus recognised in solution:—

Nitrate of silver throws down an abundant white precipitate (oxalate of silver,) which is soluble in nitric acid. The oxalate of silver when dried and heated on platinum foil, detonates, and is dissipated in a white vapour.

Sulphate of lime causes a white precipitate (oxalate of lime,) which is soluble in nitric but not in any vegetable acid.

Sulphate of copper gives a faint blue precipitate (oxalate of copper,) which is not redissolved by a few drops of hydrochloric acid. These tests will not act if the solution contain nitric acid in excess, in which case the liquid must be evaporated to crystallization, and the crystals washed and redissolved in water.

CHAPTER VII.

PHOSPHORUS.

This substance is sold to the public in small wax-like cylinders, preserved in water. It is soluble in oil, alcohol, ether, and chloroform; is luminous in the dark; and it ignites at a low temperature, giving off a dense white smoke. Phosphorus is much more frequently used as a poison in France than in England. The cases which have occurred show that it is a powerful irritant, and capable of causing death when taken in small doses. Thus a grain and a half has proved fatal in twelve days; and a child has died within three days from swallowing the heads of lucifer matches.

The *symptoms* are those due to an irritant. They come on slowly with burning and tenderness in the œsophagus and stomach, an odour of garlic in the breath, distressing thirst, vomiting of dark matters possessing a luminous appearance, and diarrhœa. There is great prostration, and sometimes convulsions.

Examples of chronic poisoning by the vapour of phosphorus are frequently seen among the makers of lucifer matches. These individuals are very liable to suffer from necrosis of the jaw, decay of the teeth, great irritability of the air-passages, disturbance of all the digestive organs, and hectic fever.

The *post-mortem appearances* have been those of inflammation of the mucous lining of the stomach and bowels. The stomach has been found contracted, and its walls softened or even perforated. In one instance, on opening the stomach, there was an escape of a white smoke, having the odour of garlic. Sometimes the viscera have appeared luminous in the dark.

The *treatment* often fails because applied too late. *Vomiting is* to be encouraged by large draughts of *mucilaginous or* albuminous drinks; and if necessary, emetics

must be administered. As phosphorus is supposed to produce its poisonous effects by its conversion into phosphorous and phosphoric acids, large doses of magnesia should be given. Oil must be avoided, since it is a solvent of this substance.

Phosphoric acid produces almost similar effects to the other mineral acids, as witnessed in its action upon animals. It is, however, much less active. This agent has never been employed as a poison. Should such an instance occur, the treatment would be that just detailed.

CHAPTER VIII.

IODINE.

IODINE is obtained from kelp (the ash of marine plants), and is a bluish-black scaly substance. It strikes an intense blue colour with starch, and when heated gives off an irritating purple vapour. It likewise imparts a yellowish-brown stain to the skin and mucous membranes, and slowly corrodes these tissues.

Iodine is an active poison, although its effects are variable. Some constitutions are violently affected by two or three grains, whereas others are uninjured by ten or twenty. This substance is commonly employed in medicine in combination with potash (iodide of potassium). The compound tincture of iodine of the London Pharmacopœia contains one grain and a half of iodine in each drachm; the liquor potassii iodidi compositus has one grain in four ounces; while the compound iodine ointment consists of five grains in three drachms.

The *symptoms* consist of an acrid taste, tightness about *the throat, epigastric pain,* vomiting, and purging, *especially if much has been* taken. In a case which can

under my own observation, a man took an ounce of the compound tincture of iodine, in mistake for a purgative draught. He was immediately seized with an intense burning pain in the throat and epigastrium, and vomiting, followed by great thirst, headache, and syncope. The vomiting was encouraged, large quantities of arrowroot given, starch enemata administered, and in twelve hours all the symptoms had disappeared, leaving him in a state of exhaustion, from which he recovered in a few days.

In chronic poisoning (iodism) there are signs of irritation of the alimentary canal, ptyalism, running from the nose and eyes, mental and bodily depression, and loss of flesh. Nothing that I have seen leads me to believe that it causes absorption of the testicles or mammæ, as is often asserted.

The *post-mortem appearances* would probably be those due to an irritant poison, namely, inflammation and corrosion of the stomach; the mucous membrane being detached in different parts, and stained of a yellow colour.

The *treatment* should consist in the encouragement of the vomiting, and the free administration of amylaceous fluids, as gruel, arrow-root, starch, &c. This should be continued until the matters vomited are of their natural colour; for as long as any iodide remains they will be rendered blue, iodide of starch being formed.

The crystals of *iodide of potassium* are white, very soluble in water, and permanent in the air; though when impure they have a yellowish tinge, and are deliquescent. In a few instances this valuable medicine appears to have given rise to troublesome symptoms, even when administered in small doses. Mr. Erichsen has reported a remarkable case in which five grains produced coryza, conjunctivitis, difficulty of breathing, and other serious effects. No chemical antidote being known, the *treatment* must consist in emptying the stomach by *emetics* or the stomach-pump, and administering de-

mulcent drinks. Should there be much pain, opiates ought to be given.

CHAPTER IX.

AMMONIA, POTASH, SODA, AND THEIR CARBONATES.

THE second division of the class of Irritants has now to be considered. It contains the Alkalies, some of their Salts, and Lime. Poisoning by any of these agents is very rare.

AMMONIA.—When pure, ammonia is a colourless, pungent gas; but it is commonly met with dissolved in water, as the liquor ammoniæ. Its vapour is poisonous, and may prove fatal by producing inflammation of the larynx and trachea, and even of the lungs. A case is recorded of a French boy, æt. six, who killed his younger sister by making her swallow several teaspoonfuls of a solution of ammonia. Other instances have also occurred where the liquor ammoniæ has either been taken in mistake for the aromatic spirits of ammonia, or purposely to destroy life.

The *Sesquicarbonate of Ammonia* (hartshorn, smelling-salts) has been used as a poison. It may be distinguished from other salts by its being alkaline, by its entire volatility, and by its pungent odour. A young woman, in a state of unconsciousness, was made to swallow a quantity of hartshorn. In an hour there was great pain, sickness, and vomiting of blood. The hæmatemesis continued for some days; and then feebleness and emaciation set in, death occurring in three months. On examination the pylorus was found contracted to the size of a crow-quill, while there was a large cicatrix on *the posterior wall* of the stomach.

POTASH.—*This* substance, in its caustic state, as

found in commerce, is in the form of gray-coloured cakes. It has an acrid taste, is soapy to the touch, and very deliquescent. Moulded in cylinders it is often employed as a caustic (Potassa fusa). In solution (Liquor potassæ) it is strongly alkaline, and imparts a brown stain to black cloth.

Carbonate of potash (Pearlash) is extensively used by laundresses, to the detriment of the linen. It is generally sold in a granular condition, white, inodorous, and strongly alkaline: it is soluble in water, but not in alcohol.

CAUSTIC SODA.—This agent resembles potash in its general properties. The *carbonate of soda* (*Soap-lees*) bears a similar resemblance to the carbonate of potash, except that it crystallizes easily, and effloresces on exposure to the air.

Symptoms.—The chief symptoms occasioned by the foregoing poisons are, an acrid corroding taste; with a sensation of excoriation and burning extending along the mouth, throat, and stomach. There soon ensues exquisite pain in the epigastrium, and tenderness on pressure. The burning is more severe after swallowing ammonia than potash or soda. Frequently there is cough, hoarseness, dyspnœa; as well as vomiting of mucus, mixed with blood and detached portions of the mucous membrane. The tongue, mouth, and fauces become swollen, soft, and flabby; and deglutition is difficult. The surface of the body gets cold and moist; the pulse small and feeble; and there is great pain over the abdomen, with diarrhœa.—Death took place in the case of a boy in three hours from the time of swallowing a strong solution of carbonate of potash. Ammonia, by its effect on the air-passages, has proved fatal in four minutes. When recovery from the immediate effects of the poison has taken place, death has subsequently ensued from stricture of the œsophagus, producing starvation. By the proper use of bougies, &c., life may occasionally be prolonged for many months, or even for years. In some

instances, however, it is almost impossible to effect dilatation owing to the whole of the gullet becoming thickened and contracted, so that the opening into the stomach will hardly admit a crow-quill.

Post-mortem Appearances.—The mucous membrane of the mouth and gullet is softened and inflamed, and portions of it detached. The coats of the stomach and intestines are inflamed, stained of a dark colour, and sometimes ulcerated. When death has resulted from ammonia, signs of inflammation have been found in the larynx and bronchial tubes.

Treatment.—The object must be to neutralize the poison, which may be effected by a weak acid. Vinegar and water is perhaps the best antidote, and the most readily procured: its administration may be followed by freely allowing acidulated demulcent drinks, orange-juice, &c. The use of oil has been recommended, on the principle that it converts the alkali into a soap. But that its efficacy is doubtful has been in some measure proved by the death of two young children from swallowing a mixture of ammonia and oil. In one of these cases nearly two ounces of linimentum ammoniæ (made of one part of liquor ammoniæ to two of olive oil) were poured down an infant's throat by a child five years old.

CHAPTER X.

NITRATE, SULPHATE, AND BITARTRATE OF POTASH; LIME; BARYTA.

NITRATE OF POTASH (*Nitre, Saltpetre, Salprunelle*).—This is a more dangerous poison than is commonly *imagined, having* caused death on several occasions *when taken in large* doses. It has generally been given *accidentally in mistake* for the saline purgatives. In

one such instance, referred to by Orfila, an ounce proved fatal in three hours. It produces symptoms of irritation of the alimentary canal, vomiting, and diarrhœa. There is generally also, severe pain at the pit of the stomach, trembling of the limbs, bloody scanty urine, and collapse.

SULPHATE OF POTASH (*Sal Polychrest, Sal de Duobus, &c.*)—It has proved fatal when taken in a large dose. It has caused death in two or three cases when purposely administered to procure abortion. Taylor quotes an instance of a lady, a week after delivery, being directed by her medical attendant to take ten drachms of this salt, in divided doses, as a laxative. After the first dose she was seized with severe pain in the stomach, with vomiting, &c.; the symptoms increasing after each quantity, and proving fatal in two hours. At the post-mortem examination, the mucous membrane of the stomach and intestines was seen soft and pale; and the stomach contained a quantity of reddish-coloured liquid. This, on being analysed, was found to contain no other irritant but this salt.

BITARTRATE OF POTASH (*Cream of Tartar, Argol*).—This salt has caused death in one case at least, in which about an ounce and a half was taken. The symptoms were those of an irritant poison, with paralysis of the lower extremities. Death occurred within forty-eight hours.

Treatment.—As no antidotes are known to these salts, the treatment must consist in producing vomiting as speedily as possible by means of emetics; or the stomach-pump may be used. Demulcent drinks should be freely given subsequently.

LIME.—It acts as an irritant poison, though a feeble one, when taken into the stomach or applied to a vital part. One fatal instance is reported, where a boy swallowed some lime in an apple-pie. He died in nine days, after suffering from a burning pain in the abdomen, great thirst, and obstinate constipation.

BARYTA AND ITS SALTS.—Pure Baryta is a caustic

alkali, but has never been used as a poison, being only met with in the laboratory. Two preparations of it have, however, caused death, viz., the chloride and the carbonate.

Chloride of Barium is found crystallized in irregular plates or tables, which are permanent in the air, soluble in water, and of a disagreeable bitter taste. Half an ounce has proved fatal in two hours; after causing symptoms of irritation, with vertigo, paralysis, and convulsions.

Carbonate of Baryta, in its native state, occurs in massive radiated crystals, very heavy, and nearly colourless. Artificially prepared, as sold in the shops, it is a fine, tasteless, odourless powder, almost insoluble in hot or cold water. One drachm is said to have destroyed life, but recovery has taken place after a much larger dose.

Treatment.—The sulphate of soda or sulphate of magnesia should be speedily administered, or some earthy sulphate, by which the poison will be converted into an inert, insoluble sulphate of baryta. Emetics should also be given, or the stomach-pump must be used.

CHAPTER XI.

ARSENIC.

The third division of the class of Irritants includes the compounds of the metals, which are very important from their frequent use as poisons. None claim greater attention on this account than the preparations of arsenic, several of which are employed in commerce. Thus, we have metallic arsenic, a brilliant brittle metal, *having a dark steel-grey* lustre; the pharmacopœial so*lution of chloride of* arsenic, containing a grain and a

half of arsenious acid in each fluid ounce; and the arsenite of potash, or Fowler's solution, or tasteless Ague Drop, also an officinal preparation, containing four grains of arsenious acid in the fluid ounce. To these must be added the arseniates of potash and soda; the sulphides of arsenic—as the bisulphide or realgar or red arsenic, and the tersulphide or orpiment or yellow arsenic; the arsenite of copper or Scheele's green; and, lastly, arsenious acid. They all produce similar symptoms; and poisoning by either of them requires the same treatment.

According to Von Tschudi some of the peasants in parts of Styria and Hungary eat arsenic, taking from two to five grains daily; the men doing so in order that they may gain strength and be able to endure fatigue, the women that they may improve their complexions. These statements are so contrary to all that we know of the power of this poison, that hitherto they have been regarded as unworthy of credit. Evidence has, however, been recently brought forward which seems to show that arsenic-eating is probably something more than a mere fiction. Advantage was taken of these reports in the trial of Miss Madeline Smith (Edinburgh, July, 1857), when the Court was asked to believe that arsenic found in the possession of the prisoner was used by her as a cosmetic!

Scheele's green or arsenite of copper (formed of one part of arsenious acid to two of oxide of copper) is unfortunately largely employed in the manufacture of green paper-hangings, artificial flowers, toys, and even some kinds of confectionery. Too many cases of ill-health caused by this practice have been recorded to prevent any doubt as to the great impropriety of its being allowed. In November, 1861, a young woman died in London from the poisonous effects of arsenite of copper used in dusting wax leaves. The workmen who employ the pigment in its dry state suffer; while those *who use it in* a moist condition are probably unaffected.

by it. A simple method for roughly detecting arseniate of copper in these fabrics has been published in the *Chemical News* (Vol. 1, p. 12). A small portion of the object is to be put into a test tube in strong ammonia. If a blue tint be produced, a salt of copper is shown to be present. Withdraw the object and drop a piece of nitrate of silver into the ammonia: if arsenic be there, the nitrate of silver will be covered with a yellow coating of arseniate of silver, which will disappear on stirring. On igniting arsenical paper and allowing it to smoulder, the odour of garlic may be detected in the fumes given off.

ARSENIOUS ACID (*White Oxide of Arsenic, White Arsenic, Arsenic*). This is the preparation of arsenic most frequently used as a poison; the facility with which it may be procured, its cheapness (two-pence an ounce), and the ease with which it may be administered, all tending to recommend it to the murderer or suicide. According to a parliamentary report, the number of fatal cases of poisoning in England in the years 1837, 1838 amounted to 543, of which no less than 186 were caused by arsenic; 185 arising from the use of the arsenious acid, and 1 from orpiment or yellow arsenic.

Since the act of 1851 (14 Vict., cap. xiii.) the deaths from this agent have decreased. This statute chiefly enacts that arsenic is not to be sold without the seller entering the transaction in a proper book, without a witness, nor without its being mixed with soot or indigo, unless such admixture would render it unfit for the purchaser's business.

Arsenious acid is found in commerce in the form of a white powder, or in small opaque cakes. It is very feebly acid; tasteless, or slightly sweet, in small doses; and very soluble, an ounce of cold water dissolving about one grain. The shortest period within which it has caused death is two hours. The smallest quantity known to have proved fatal is two grains and a half, from which *a girl nineteen years of age* died in thirty-six hours. *Half a grain will produce* alarming symptoms; and yet re*covery has ensued after* doses of half an ounce or an ounce.

Symptoms.—These commence within half an hour or an hour of swallowing the poison. There is faintness, nausea, incessant vomiting, and a burning pain in the epigastrium increased on pressure, and gradually extending over the whole abdomen; followed by headache, diarrhœa, a sense of constriction and heat in the fauces and throat, great thirst, and catching, painful respiration. The heart's action becomes depressed, the pulse quick and feeble; there is great restlessness and anxiety; cold, clammy skin, and perhaps coma; and death usually occurs within twenty-four hours.

These symptoms are liable to great variety, the pain and vomiting being occasionally absent, and the patient being affected as if by a narcotic poison. In some instances there is troublesome tenesmus, with heat and excoriation about the anus. Convulsive movements in the extremities often occur, with cramp in the legs, especially if the diarrhœa is severe. Death sometimes takes place calmly from collapse, sometimes accompanied by convulsions.

The vomited matters may be red or brown from admixture with blood or bile; or they may be blue or black if the arsenic has been coloured with indigo or soot. Although the vomiting, pain, &c., are generally continuous, yet sometimes all the symptoms remit, and the patient rallies for a time.

The symptoms of *chronic* poisoning by arsenic are loss of appetite, a silvery coating to the tongue, hoarseness, thirst, nausea, colicky pains, diarrhœa, frontal headache, languor, sleeplessness, cutaneous eruptions, soreness of the edges of the eyelids, emaciation, anæmia, convulsions, and death. In some cases when small doses have been administered for many days in succession with the intent to destroy life, the symptoms have been masked. The most marked results of this practice have been vomiting, pain in the bowels, nervous irritability, and emaciation. The practitioner must be careful not to mistake the symptoms *for those* due to simple gastritis or enteritis.

Arsenic is not a poison that accumulates in the system, but is slowly eliminated from it, especially by the kidneys. This opinion, however, is contrary to that entertained by one or two authors.

The local application of arsenic to the mucous membranes, to wounds, or to surfaces deprived of their cuticle, produces constitutional effects similar to those just described. The only difference is that the symptoms show themselves more slowly. Not a few lives have been sacrificed from the application by ignorant quacks of a mixture of arsenious acid, realgar, and oxide of iron to ulcerating cancers.

Cases of compound poisoning have been met with. When arsenic is taken mixed with opium, the symptoms produced by the former are masked.

Post-mortem Appearances.—Arsenic appears to exercise a specific influence over the alimentary canal, and more especially over the stomach; for in whatever manner it may have been introduced into the system, it is to this organ that we must look for its effects. These effects consist in the signs of acute inflammation, commencing in this viscus, and often extending along the duodenum, small intestines, and colon, &c. In such cases the stomach is the viscus most affected; but in chronic cases the whole alimentary canal is found inflamed, particularly the duodenum and rectum. When death has occurred in five hours, the stomach has been found intensely inflamed, in an adult; while the same result was witnessed in a child who died at the end of two hours. The stomach often contains a dark grumous fluid, occasionally tinged with blood. On removing the contents, the mucous membrane is seen red and inflamed, and perhaps covered with yellow pasty-looking patches of arsenic, the inflammation being most intense around these spots. Ulceration of any of the coats of the stomach is rare, and perforation is still more so.

In a few exceptional cases there has been no appearance *of inflammation in the* stomach or bowels.

Putrefaction of the body is said to be remarkably retarded after death from arsenic.

Treatment.—The first object must be to expel the poison from the stomach; for which purpose the stomach-pump may be advantageously employed, or emetics of sulphate of zinc or mustard administered, unless vomiting is already present. The sickness must be promoted by the free use of albuminous or mucilaginous diluents. Raw eggs beaten up in milk are particularly useful, as is likewise a mixture of albumen, milk, and lime-water. Taylor advises equal parts of oil and lime-water, for the oil invests the poison, and the lime renders it less soluble. A large dose of castor-oil (℥j to ℥ij) may be given, to carry off any of the poison which may have passed into the intestines. Animal charcoal, calcined magnesia, &c., when taken in large quantities, may be of service by enveloping the arsenic, and preventing its contact with the mucous membrane of the stomach; but oil or milk will act more efficiently in this manner. The hydrated sesquioxide of iron,* at one time much lauded as an antidote to arsenic, has more recently been thought almost useless by Orfila, Guy, Taylor, and other authorities. It would appear from their experiments, that the cases reported as successfully treated by this substance were evidences of *post hoc*, therefore *propter hoc* reasoning. If, however, it is tried, it should be administered moist, and in large doses (as a table-spoonful frequently repeated), after the stomach-pump, &c., has been used.

The subsequent treatment must be conducted on general principles, according to the severity of the symptoms; but the great depression of the nervous and vascular systems must not be overlooked in combating any inflammatory action. Chloroform, henbane, or opium,

* Prepared by dissolving the sesquioxide of iron at a gentle heat in diluted sulphuric acid, and decomposing the hot solution *with* an excess of liquor ammoniæ; the precipitate must be washed *in warm water*, drained, and kept in a moist state.

in many instances combined with stimulants, will frequently be found of great service.

Tests.—In its *solid state* arsenic may be known by the following properties. Heated on platinum foil, or on the point of a penknife, it produces a white smoke, and is entirely volatilized.—If some of the powder be heated in a small test tube, it will be sublimed, and small octahedral crystals obtained.—If arsenious acid be mixed with freshly-burnt powdered charcoal, and heated in a small test-tube, a ring of shining metallic arsenic of a grey colour will be found on the cool portion of the tube. This is called the reduction-test. It is very delicate, detecting, according to Christison, the 300th part of a grain.

In solution, this substance may be detected by what are called the liquid tests. A solution of arsenic in water is colourless, almost tasteless, and has a very slight acid reaction; and if a few drops be evaporated on a glass slide and examined by the microscope, numerous minute octahedral crystals will be seen, presenting triangular surfaces by reflected light. The *ammonio-nitrate of silver* (prepared by adding a few drops of liquor ammoniæ to a solution of nitrate of silver, till the brown oxide of silver at first precipitated is nearly re-dissolved) throws down a rich yellow deposit of arsenite of silver. The *ammonio-sulphate of copper* (formed by adding liquor ammoniæ to a solution of sulphate of copper till the bluish-white oxide of copper is almost re-dissolved) produces a pale green precipitate, arsenite of copper or Scheele's green. *Sulphuretted hydrogen water* precipitates a yellow deposit of sulphide of arsenic. These tests are so delicate, especially the first, that they will detect the 8,000th part of a grain of arsenic in solution; they should be employed successively. There are three other tests which require *to be noticed*, namely, the gaseous test, Marsh's test, *and the process* known as Reinsch's.

The gaseous test.—This consists in passing a stream

of sulphuretted hydrogen gas through the solution, previously acidified by some acid (as the acetic), when a yellow precipitate will be produced. The rapidity with which this forms will depend upon the quantity of arsenic present. Peroxide of tin and cadmium give a similar precipitate under the same circumstances, but these substances are very rarely met with. The precipitated sulphide of arsenic should be examined by collecting, drying, and applying to it the reduction test. Incinerated acetate of soda is to be employed instead of charcoal; or black flux (made by calcining one part of nitrate of potash with two of bitartrate) may be used. The crust obtained will consist of metallic arsenic, arsenious acid, and undecomposed sulphide.

Marsh's test.—This process is founded on the decomposition of arsenious acid by nascent hydrogen, and the formation of arseniuretted hydrogen gas, which possesses the following properties. It burns with a bluish-white flame, and white smoke (arsenious acid) possessing a slight garlic odour. If a piece of glass or porcelain be held in the flame, a blackish stain will be deposited upon it, consisting of metallic arsenic. This stain might be confounded with one produced by antimony under similar circumstances. But the antimoniuretted hydrogen gas does not burn with the odour of the arseniuretted hydrogen; while the antimonial stain is sooty, and has not a metallic lustre. Moreover, the presence of arsenic is proved by moistening a piece of white porcelain with the ammonio-nitrate of silver, and holding it above the flame, when the yellow arsenite of silver will be obtained.

This test may be applied in the following simple manner:—Introduce some pieces of pure zinc into a wide-mouthed phial, and pour over them a mixture of the suspected liquid with diluted sulphuric acid. Close the bottle with a cork perforated by a short piece of *glass tube*. When the atmospheric air has been quite *expelled*, apply a light to the jet of gas.

Reinsch's process.—The suspected liquid is boiled with a few drops of pure hydrochloric acid, and a bright slip of copper introduced. If arsenic be present, the copper will be coated with it, in the form of an iron-grey deposit. By removing the copper, washing and drying it, and introducing it into a reduction-tube, arsenious acid will be sublimed and deposited on the sides, in the form of minute octahedral crystals. Before resorting to this test, the acid must be examined to make sure of its purity. This is easily effected by boiling the copper with a mixture of the hydrochloric acid and distilled water before adding the suspected liquid. In conducting the analysis in the case of Smethurst (Cent. Crim. Court, Aug. 1859) Taylor and Odling found that all the varieties of copper in common use for Reinsch's process contained arsenic. A copper of ascertained purity must therefore be procured.

Arsenic in Organic Matters.—The following process is that proposed by Fresenius, and recommended by Bloxam and Guy :—If the matters are solid they must be broken up, and mixed with water till they are of the consistence of gruel. If already fluid, the chemist proceeds at once to digest them for an hour, in a porcelain dish over a water-bath with about one ounce of hydrochloric acid, adding powdered chlorate of potash occasionally until the organic matters are disintegrated. The resulting liquid is then to be filtered off, and evaporated over the water-bath to about an ounce. This is to be poured into a flask, a few drops of a strong solution of bisulphite of soda are added to it till it smells strongly of sulphurous acid, and the flask is then heated in a water-bath till this odour ceases. The resulting solution, mixed with an equal bulk of water, is then to be tested for arsenic by one or all of the methods already described.

CHAPTER XII.

MERCURY AND ITS COMPOUNDS.

Of the preparations of mercury, corrosive sublimate is the most important to the toxicologist; for although they all possess in a greater or less degree poisonous properties, yet the instances in which the other compounds have been used to destroy life are extremely rare. The treatment in all cases must be the same. It is worthy of remark that liquid mercury is destitute of injurious properties; large doses (from half a pound to two pounds) having been given in obstinate cases of constipation, intussusception, &c., without any remarkable effect.

Bichloride of Mercury (*Oxymuriate of Mercury, Chloride of Mercury, Corrosive Sublimate*).—This preparation of mercury is sold to the public for about sixpence an ounce, to destroy vermin, to preserve stuffed animals, &c. It is usually met with in the form of imperfect crystalline masses, or as a white powder. It has an acrid, coppery taste, so powerful that but little could be swallowed without the individual becoming aware of it. It is very soluble in water. The Pharmacopœial solution contains the one-sixteenth of a grain to the drachm of water. Three grains is the smallest quantity that has been known to prove fatal; and from this to five grains may probably be stated as the average dose necessary to destroy life. Recovery has taken place after as much as forty grains had been swallowed. Death has occurred in less than half an hour; while, in some instances, life has been maintained until the sixth day, and in one instance (where between three and four scruples had been swallowed) until the twelfth day. It is probable that the average duration of fatal cases is from twenty-four to thirty-six hours.

Symptoms.—In the majority of cases the symptoms

commence immediately, with an acrid metallic taste, and a sense of constriction and burning heat in the throat and stomach. The burning pain gradually extends over the abdomen, and is much increased by pressure. There is nausea, with vomiting of the contents of the stomach. These matters are sometimes mixed with blood and stringy masses of mucus. The sickness is accompanied by diarrhœa or dysentery, swelling of the abdomen, and increased pain. The countenance becomes flushed and often swollen, though it is occasionally pallid and anxious; the lips and tongue get white and shrivelled; there is frequently some dyspnœa, while the pulse is small or wiry and frequent; and death is preceded by faintness, cramps, insensibility, or convulsions.

Should these effects not prove rapidly fatal, the pain will gradually become lessened, though attacks of colic and nausea may come on at intervals for several days. Often the secretion of urine is almost, or even quite suppressed; and there are symptoms of hectic fever, with much depression. The gums and salivary glands also become swollen, there is a coppery taste, the breath is very fœtid, and there is severe ptyalism or salivation. This latter effect is the most prominent feature in the *chronic* form of poisoning, where small and frequently-repeated doses have been given: it often proceeds to such an extent as to cause death, when the patient would otherwise probably recover.

It must not be forgotten that salivation sometimes arises where no mercurial of any kind has been given. Thus arsenic, bismuth, lead, iodide of potassium, opium, &c., may induce it in some very peculiar constitutions. Small medicinal doses (as a few grains of calomel) may also excite it in certain susceptible individuals; and especially in persons suffering from renal disease. It may also occur spontaneously, as in stomatitis or inflammation of the *mouth; and I* have met with some very troublesome *examples of this fact in* pregnant women.

It is strange that neither in acute nor chronic mer-

curial poisoning do we observe any marked loss of muscular power. Yet workers in quicksilver (owing to the absorption of the fumes of mercury during respiration) are very apt to suffer from a peculiar kind of paralysis; which commences with inability to direct the hands and arms, and goes on to a shaking or trembling of all parts of the body.

The phenomena now described will not be confounded with those produced by arsenic, if it be remembered that the latter substance is almost tasteless, that it has but little effect upon the throat, and that its effects do not commonly show themselves until half an hour after it has been taken.

Post-mortem Appearances.—The appearances produced by corrosive sublimate are confined chiefly to the digestive canal. The mucous membrane of the mouth, fauces, and œsophagus is softened and of a bluish-grey colour; as is frequently that of the stomach. The latter viscus also presents marks of inflammation; beneath the mucous membrane numerous patches of extravasated blood are seen; and frequently corrosion or ulceration has been found. The large and small intestines, the peritoneum, and especially the urinary organs, often appear inflamed. In many instances the bladder has been much contracted.

Treatment.—This must consist in the removal of the poison and the administration of antidotes. Vomiting is best promoted by administering copious draughts of fluids containing the latter; but if necessary, an emetic may subsequently be given. Various antidotes have been recommended for this poison. Among these albumen and gluten of wheat are the most to be relied upon; the albumen acting upon the bichloride so as to form an insoluble combination. The white and the yolk of raw eggs should therefore be abundantly given; for although one egg has been thought sufficient to render four grains of the poison innocuous, yet no injury can result from giving too many, as they will promote vomiting. Gluten

has been much recommended, and may readily be prepared by washing flour in a muslin bag, under a stream of water; but on an emergency it will be best to exhibit the flour at once, made into a paste with milk or water. Several other antidotes have also been proposed, as iron filings, gold dust and iron filings diffused in mucilage, the hydrated protosulphuret of iron, &c.; but in the present state of our knowledge, it will be advisable to employ those substances only, with whose action we are fully acquainted.

The after-treatment demands a few words of notice. The free use of demulcent drinks, milk, and Wenham Lake ice will be very grateful to the patient's feelings. Gargles of alum, or borax, do some good. Opiates may be given in small doses, if there be much pain. And we should allow only a milk or farinaceous diet. Chlorate of potash has been recommended to check the salivation. The most useful remedy, however, is the iodide of potassium; for this salt destroys the compounds formed by the union of mercury with certain of the tissues, and eliminates the poison through the kidneys.

Tests.—Corrosive sublimate is volatilized by heat. This is also the case with arsenic and calomel, but it is distinguished from these by its solubility in water.—Liquor potassæ added to it changes it to a yellow colour; and this is conclusive, as arsenic is unaltered by this test, and calomel is turned black. On adding a solution of iodide of potassium to a small quantity of the powder, a bright scarlet colour is produced. If a drop or two of a solution of corrosive sublimate, slightly acidulated with hydrochloric acid, be placed on a sovereign, and the solution and the gold be touched with a piece of zinc or iron, the mercury will be deposited as a bright silvery stain.

CALOMEL (*Subchloride or Chloride of Mercury*).—A *heavy white powder*, which is usually regarded as a safe *medicine. Yet, in* some peculiar constitutions, it has *caused excessive* salivation and death; even though only

a few grains have been given. In large doses it may be regarded as an irritant poison.

AMMONIO-CHLORIDE OF MERCURY (*White Precipitate*).—This substance is a chalky-looking powder, containing about eighty per cent. of mercury. It produces vomiting, purging, great pain in the stomach, cramps, and convulsions. Out of fourteen cases, collected by Dr. Taylor, in which from a few to forty grains were taken, only two proved fatal.

The remaining preparations of mercury, which in rare instances have been used as poisons, are the *Red Oxide of Mercury* (red precipitate); the *Bisulphuret of Mercury* (cinnabar, or vermilion); the *Cyanide of Mercury;* the *Nitrates of Mercury;* and *Turbith Mineral.*

CHAPTER XIII.

PREPARATIONS OF LEAD.

LEAD, in its metallic state, is not injurious. It is, however, readily acted on by acids, exposure to the atmosphere, &c., and converted into carbonate of lead. The chief compounds of this metal, which have been found to produce poisonous effects, are the acetate, subacetate, and the carbonate.

ACETATE OF LEAD (*Sugar of Lead*).—This is sold at about twopence an ounce, as a glistening white powder, or in the form of crystalline masses resembling loaf-sugar. It is more frequently used as a poison than either of the other compounds. It is very soluble in water, and has a sweetish metallic taste. Three or four instances are recorded in which recovery has taken place after an ounce of this substance has been taken in solution.

Mr. Baucks, of Stourbridge, has reported the parti-

culars of a series of cases of poisoning by the acetate of lead (*Lancet*, 5th May, 1849). It appears that thirty pounds of this substance were accidentally mixed at the miller's with eighty sacks of flour. This was made into bread, from eating which 500 persons suffered severely. The chief symptoms were a sense of constriction in the throat and at the pit of the stomach, crampy pains round the navel, stiffness of the abdominal muscles, paralysis of the lower extremities, constipation, scanty urine, and the formation of a deep blue line round the gums. Although in many cases there was great prostration with other alarming symptoms, yet under the use of purgatives all recovered. It was noticed that after a temporary convalescence many of the symptoms returned in an aggravated form without any apparent cause.

SUBACETATE OF LEAD (*Goulard's extract*).—This substance is known to have proved fatal in three or four instances, after having caused great agony. It is a more powerful poison than the acetate; probably owing to its containing a large quantity of the oxide of lead. It is found in the shops as a whitish-coloured liquid.

CARBONATE OF LEAD (*White-Lead, Ceruse, &c.*).—This is sold in heavy white masses, looking like chalk. It is readily acted on by acids, but is very insoluble in water. Wine has been rendered poisonous by this salt, owing to shot (left in the bottle after cleaning) being acted upon by the vegetable acids.

Dr. Snow has reported an instance in which a child ate a portion, about the size of a marble, mixed up with oil, and died on the fourth day. Carbonate of lead derives its greatest interest from the chronic form of poisoning which it produces among white-lead manufacturers, painters, &c., known as "the painters' colic," which too often terminates in "lead palsy." In these instances the lead finds its way into the system by absorption *from* the digestive canal, the lungs, or the skin; *producing its* characteristic effects when a sufficient *amount has been* absorbed. This subject will be again

referred to. It is this salt which is formed by the action of air and water upon lead.

The other preparations of this metal, as the *oxides*, the *sulphate*, the *chloride*, and the *nitrate* do not require any separate notice.

Symptoms.—All the salts of lead act as weak irritant poisons. They produce, in a marked degree, constipation; thus differing from the other irritants. When taken in large doses, the chief symptoms are a lancinating, constrictive, peculiar pain in the throat and œsophagus; together with great dryness and thirst. There is an aching pain (colic) in the epigastrium, gradually extending over the abdomen, which becomes tense: the pain is relieved on pressure. As just mentioned, the bowels are obstinately constipated, the skin becomes cold, the countenance is livid, and there is much prostration. The mental faculties are undisturbed. In fatal cases, great exhaustion sets in; and there are cramps, with sometimes paralysis of the extremities, and convulsions. A well-defined blue line on the margin of the gums round the teeth has been pointed out as characteristic of the action of lead upon the system. It is, however, occasionally absent; and it has been noticed in a few cases of chronic poisoning by corrosive sublimate.

Post-mortem Appearances.—They are not usually very distinct. The stomach and intestines have been found inflamed, and the villous surface of the former softened and corroded. In a case of poisoning with Goulard's extract, the mucous membrane of the stomach was of a grey colour, but not otherwise altered.

Treatment.—This consists in the exhibition of the soluble alkaline or earthy sulphates—the sulphates of soda or magnesia. Either of these may be freely given, dissolved in water. Milk, or milk and eggs, will be useful. If vomiting is absent, an emetic of sulphate of zinc should be administered; or the stomach-pump may be advantageously employed. As a purgative no remedy is better than *croton oil.*

For a chemical antidote in poisoning by carbonate of lead, Dr. Taylor recommends a mixture of vinegar and sulphate of magnesia.

Tests.—The presence of a salt of lead in solution may be thus ascertained :—On passing sulphuretted hydrogen through it, or on adding a few drops of sulphide of ammonium, a black precipitate is given. A white precipitate results from the use of liquor potassæ, or liquor ammoniæ. Dilute sulphuric acid gives a similar precipitate, which is soluble in hydrochloric acid. Iodide of potassium affords a yellow deposit (iodide of lead).

Chronic Lead-Poisoning.—The chronic and insidious effects produced by lead upon the constitution are deserving of careful attention. Water impregnated with this metal in its passage through new pipes or cisterns, acquires poisonous properties. Lead-pigments are sometimes improperly used to colour cheese, lozenges, snuff, &c. The endemic colic of Devonshire was due to the absorption of lead contained in cider, which had been stored in leaden vessels ; and in the wine district of Poictou attacks of colic were so common, from the impregnation of wine with this metal, that we still speak of Colica Pictonum.

The pernicious influence of lead is manifested among those engaged in the manufacture or use of lead compounds, especially painters, lead-smelters, plumbers, colour-grinders, shot manufacturers, workers in sugar of lead, potters, compositors, enamellers of cards, &c. These artisans should be advised to prevent disease by great cleanliness, by avoiding intoxicating liquors, and by drinking freely of sulphuric acid lemonade. The substitution of moist for dry grinding has proved useful.

The most prominent *symptoms* of chronic poisoning by lead are as follows :—A blue line around the gums, and the liability of the latter to bleed from any slight cause ; emaciation, a waxy tint of the complexion, poorness of blood, an a feeble quick pulse ; obstinate constipation, with attack of colic relieved by pressure ; diminution of the ver

secretion, and rheumatic pains; weakness of the hands, wrists, and arms, ending in paralysis; amaurosis; and at length apoplexy.

The *treatment* of these cases must consist in the use of purgatives; none being better than full doses of croton oil, or of castor oil, or of sulphate of magnesia with the dilute sulphuric acid. Hot baths containing four ounces of sulphuret of potassium to the thirty gallons of water give great relief. Opium must be employed to procure sleep at night. But the remedy of all others, is the iodide of potassium, in five or ten grain doses thrice daily; this agent acting most beneficially when employed in conjunction with galvanism to the paralysed limbs.

CHAPTER XIV.

SALTS OF COPPER.

Poisoning with the salts of copper is of rare occurrence; when it happens, it is generally the result of accident. The metal itself is not poisonous, but the action of the alkaline chlorides in the stomach may produce a very deleterious salt. Copper coins, when swallowed, sometimes on this account prove mischievous; though usually any ill effects which ensue are due to their mechanical action. The salts of copper have been accidentally introduced into the system by means of food which has been cooked in copper saucepans. The most important substances of this class to the toxicologist are the following:—

Sulphate of Copper (*Blue Vitriol.*)—Blue-stone is met with in large crystals, which are very soluble in water, and possess an acrid metallic taste. In doses of half an ounce it acts as a powerful irritant. It has been administered to procure abortion. In the case of a child sixteen months old who sucked some pieces of blue-stone *with which* she was playing, death occurred in four hours.

SUBACETATE OF COPPER (*Verdigris*).—This preparation is met with in earth-like masses, or in the form of a greenish powder, having somewhat the smell of vinegar. It possesses a powerful astringent metallic taste.

ARSENITE OF COPPER (*Mineral Green*).—The effects of this salt have been already referred to. See p. 33.

Symptoms.—Pain in the epigastrium gradually extending over the abdomen, violent vomiting—the vomited matters being of a blue or green colour—and diarrhœa, are the symptoms which set in the most speedily. Then there is usually dyspnœa, great depression, coldness of the extremities, headache with giddiness, and slight tetanic convulsions. Sometimes there is suppression of urine. Jaundice very frequently occurs; a symptom the more important, as it is rarely met with in other cases of poisoning. Occasionally stupor, coma, and paralysis supervene. Should death ensue, it may occur within a few hours, or not for several days.

The salts of copper taken in very small doses, for several days, give rise to a metallic taste in the mouth, thirst, debility, cramps and colicky pains, with symptoms of dysentery. In some instances there has been found retraction of the gums with the formation of a purple line, very distinct from the blue mark due to lead.

Post-mortem Appearances.—Evidences of inflammation are usually found in the stomach and intestines, the mucous membrane being often ulcerated and of a green colour. Particles of the poison may sometimes be found adhering to the coats of the bowel. Perforation of the intestines has occurred.

Treatment.—Vomiting sets in spontaneously, and is to be encouraged by the use of warm water. The stomach-pump will rarely be needed. The only effectual antidote is albumen. The white and yolk of several eggs should therefore be given, followed immediately by milk or mucilaginous drinks. Sugar, iron-filings, and the ferrocyanate of potass have been recommended as antidotes.

Tests.—Solutions of the sulphate and nitrate of copper

are blue; the chloride is green. The salts of copper may be thus identified:—a polished knife or needle introduced into the solution, is soon covered with a coating of copper. Ferrocyanide of potassium gives a claret coloured gelatinous precipitate, if the copper be abundant; otherwise, the deposit is of a light brown. Sulphuretted hydrogen gas yields a deep brown precipitate. A few drops of the copper solution are to be placed on platinum foil, and slightly acidulated: on touching the foil, through the solution, with a strip of zinc, metallic copper is deposited on the platinum.

CHAPTER XV.

ANTIMONIAL COMPOUNDS.

In its metallic state antimony is not regarded as poisonous. Two of its preparations, however, claim attention; namely, tartar emetic, and chloride of antimony.

Tartarized Antimony (*Potassio-Tartrate of Antimony, Tartar Emetic*).—Since the trials of Palmer, Dove, and Smethurst, poisoning by this compound has attracted much attention. It owes its irritant properties to its containing 44 per cent. of oxide of antimony. In large doses, it has been administered without any serious result; a circumstance which may be accounted for by the promptitude with which it excites vomiting and purging. Given in small doses, frequently repeated, the effects of tartar emetic may be made to resemble those due to natural disease.

Tartar emetic is used in medicine thus: as a sudorific, gr. $\frac{1}{16}$ to gr. $\frac{1}{8}$; as a nauseating depressant gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$; as an emetic, gr. j to gr. iij. The officinal vinum antimonii *potassio*-tartratis contains two grains of the salt.

to each ounce; while the pharmacopœial ointment consists of one drachm to five drachms of lard.

Three-quarters of a grain killed a child; and a dose of two grains has destroyed an adult, under circumstances which favoured its action. Dr. Taylor says that from ten to twenty grains taken at once might prove fatal to an adult; while in divided doses, a smaller quantity would suffice.

Symptoms.—In acute poisoning by this agent there is a metallic taste, nausea and violent vomiting, burning heat with pain in the stomach, and purging. Difficulty in swallowing, thirst, cramps, cold perspiration, loss of power, and great debility soon set in. The secretion of urine is increased. If the case seems about to end fatally we shall find dyspnœa, blueness of the lips and face, loss of voice, an almost imperceptible pulse, and delirium; but even in these instances, when matters appear to be most critical, symptoms of improvement are often manifested, and recovery gradually follows.

The effects of *chronic* poisoning are constant nausea, frequent attacks of vomiting and purging, a loathing for food, a weak frequent pulse, loss of muscular power, cold clammy sweats, and fatal exhaustion. The symptoms are of course aggravated after each administration of the poison, whether given in food or medicine.

Tartar emetic ointment applied to the skin produces a pustular eruption like that of small-pox; while if much be absorbed, there will be nausea, sickness, &c.

Post-mortem Appearances.—The most common are inflammation of the throat, stomach, and intestines. Sometimes the mucous membrane of the stomach is corroded; or aphthous ulcerations may be present. The brain and lungs have been found congested.

In chronic cases, the liver has been enlarged and softened.

Treatment.—Vomiting should be encouraged by warm *greasy water, milk, &c.* Tannate of antimony is regarded *as inert, and hence* an infusion containing tannin (tea,

decoction of oak bark, &c.) must be freely given. Cinchona bark in tincture or powder may be advantageously administered.

Tests.—As a solid it is soluble in water but not in alcohol: treated with sulphuretted hydrogen water or hydrosulphuret of ammonia, a reddish-brown sulphide is formed. In solution it may be thus detected:—A drop evaporated on a glass slide leaves microscopic crystals, either tetrahedra or cubes, with the edges bevelled off. Dilute nitric acid gives a precipitate of sub-nitrate of antimony, which is dissolved by tartaric acid or by a large excess of nitric acid. Hydrosulphuret of ammonia or sulphuretted hydrogen gas will produce an orange-coloured precipitate.

Chloride of Antimony (*Sesquichloride or Butter of Antimony*).—A powerful corrosive liquid. It has been given in mistake for antimonial wine, which it somewhat resembles, unless it contains iron, when it is of a dark red colour. It produces violent inflammation and corrosion of the whole intestinal canal; with drowsiness, as from the use of a narcotic.

Dr. Taylor has collected the histories of four cases of poisoning by butter of antimony, three of which recovered. The fourth, in which a gentleman took from two to three ounces, proved fatal in ten hours and a half; after producing great prostration, nausea, violent griping pain, and tenesmus, followed by a tendency to sleep. On inspection, the whole of the inside of the alimentary canal was blackened, as if it had been charred; there was but little mucous membrane remaining, and the parts were much softened.

Treatment.—Magnesia must be administered in milk, followed by the remedies recommended in poisoning by tartar emetic.

CHAPTER XVI.

ZINC. SILVER. TIN. BISMUTH. CHROME. IRON.

Two preparations of zinc must be noticed :—

Sulphate of Zinc (*White Vitriol, White Copperas*).—This is a very mild irritant, resembling in its appearance Epsom salts and oxalic acid. It is very useful as an emetic in scruple or half-drachm doses, dissolved in any thin fluid.

In one case an ounce was accidentally taken. Great pain in the stomach, vomiting, and prostration soon set in. Subsequently there was gastritis, and recovery only occurred after a prolonged convalescence.

Treatment.—Vomiting is to be encouraged by milk or albuminous fluids; and then remedies containing tannin (strong tea, decoction of oak bark, or tincture of Peruvian bark) are to be given.

Chloride of Zinc.—A solution of chloride of zinc forms a valuable disinfectant. Sir William Burnett's Fluid consists of gr. xxv of this salt to the drachm of water. It has been taken in mistake for fluid magnesia, pale ale, &c., and has caused death.

Symptoms.—A burning sensation in the mouth and throat is immediately produced; followed by nausea, vomiting, and signs of collapse. Death has occurred in four hours.

Post-mortem Appearances.—The mucous membrane of the throat and stomach has been found corrugated, hard, and leathery. In the case of a sailor who died from about half a pint of Burnett's solution, the body was livid, the neck swollen, the cerebral vessels were engorged, *and the lungs* were congested. The mucous coat *of the stomach was* of a purple red, and partially cor-

roded; while the pyloric orifice looked as if caustic had been applied to it. There were patches of congestion in different parts of the small intestines.

Treatment.—Emetics and albuminous drinks, followed by some preparation of tannin, will be needed.

NITRATE OF SILVER (*Lunar Caustic*).—This is a powerful corrosive, and has proved fatal in at least two instances. The antidote is common salt, which must be given immediately, followed by emetics.

TIN.—The chlorides of tin being employed in dyeing, colour-making, &c., might lead to their being used as poisons, or being taken accidentally. They are decomposed by magnesia, which should therefore be freely administered; followed by albuminous and mucilaginous drinks.

BISMUTH.—The nitrate or magistery of bismuth has caused death in nine days, after a dose of two drachms. The symptoms were those of a strong irritant. As no antidote is known, vomiting must be promoted, and emollient drinks freely given.

CHROME.—The bichromate of potash is found in the form of orange-red crystals, which yield a yellow acid solution. It is used as a dye, and has caused death in one instance. Emetics, and magnesia or chalk, must be the remedies employed.

SULPHATE OF IRON (*Green Vitriol, Copperas*).—Although not a powerful irritant, sulphate of iron has proved fatal when taken in a large dose. It is sometimes given to procure abortion.—The *tincture of sesquichloride of iron* has also produced alarming symptoms, after being taken for the same purpose. Dr. Christison relates the case of a man who died in five weeks from an ounce and a half of this liquid. Magnesia and diluents, freely administered, must constitute the treatment.

CHAPTER XVII.

VEGETABLE AND ANIMAL IRRITANTS.

THESE constitute the fourth division of the class of irritants, which is an important one, on account of the substances composing it frequently producing accidental poisoning. The vegetable and animal irritants chiefly give rise to vomiting and purging.

VEGETABLE IRRITANTS.—They are very numerous, and are most of them employed as medicines. It is only, therefore, when given in undue proportions that they excite serious symptoms. The most important are —aloes, arum maculatum, bryony, capsicum, castor-oil seeds, croton-oil seeds, creosote, colocynth, elaterium, elder, euphorbium, gamboge, jalap, mesereon, mustard, savin, scammony, sorrel, stavesacre, and turpentine. Dr. Taylor says that aloes and colocynth are the basis of *Morrison's pills*, which in many instances have induced fatal purging. In *Holloway's pills*, aloes is the chief ingredient. A favourite remedy with nurses for promoting the catamenia, is *hierapicra*, a brown powder consisting of four parts of aloes to one of canella bark.

The Symptoms are those of irritation of the intestinal canal, severe pain, vomiting, diarrhœa, tenesmus, &c.; followed by collapse, cold sweats, and occasionally convulsions. These effects may also be produced by diseased and decayed vegetables.

The Treatment must be directed to the removal of the injurious substance by emetics, &c., unless spontaneous vomiting has freely taken place, when it may merely be encouraged by the use of diluents. If the irritant has *passed* out of the stomach into the intestines, it must be *carried off by purgatives*, especially by castor oil. The *inflammatory symptoms* should be cautiously combated, on

account of the great prostration usually caused by these poisons. Opiates, emollient enemata, and fomentations to the abdomen will subsequently be found useful.

ANIMAL IRRITANTS.—The substances which require consideration under this head, though few, are important.

Cantharides (Spanish Flies).—This poison is well known, and is usually administered in the form of powder or tincture. Of the former, twenty-four grains has destroyed life; of the latter, one ounce. The officinal Acetum Cantharidis contains four drachms of powdered cantharides in five ounces; the Emplastrum Cantharidis consists of one drachm in two drachms; while the Tincture has one drachm in ten ounces. This poison has been employed as an aphrodisiac, and to induce abortion. Applied externally, it has proved fatal, as in the case of a girl affected with scabies, who anointed the whole of her body with cantharides ointment in mistake for that of sulphur. She died in five days, after suffering from the symptoms of poisoning by cantharides.

It produces an acrid taste, vomiting, purging, burning heat in the stomach, pain in the loins, severe strangury, bloody urine, and priapism. Then there is faintness with giddiness, the limbs become rigid, and delirium with convulsions precede death. Sometimes the matters ejected from the stomach or passed in the stools contain shining golden or green particles, readily seen with a lens.

After death, marks of inflammation are found in the alimentary canal, kidneys and bladder, and the genital organs.

No antidote is known. Vomiting must be excited or encouraged; and linseed tea, or gum water, or gruel copiously administered. The warm-bath will afford great relief. Oil must be avoided on account of its being a solvent of the active principle (cantharidine) of this poison.

Poisonous Fish.—Several kinds of fish are constantly poisonous, while some only act injuriously on particular constitutions. The chief effects are irritation of the eyes, depression, and severe urticaria or nettle-rash. In this country the different varieties of shell-fish are the most frequently injurious, especially cockles, mussels, crabs, and such like.

Poisonous Meats.—The flesh of animals which have died of disease has produced serious symptoms when eaten, and has even destroyed life. Several substances, as sausages, cheese, bacon, &c., have become poisonous from putrefaction.

The Treatment in these instances should consist in the use of emetics, purgatives, and diluents. The vital powers must be supported by stimulants, tonics, nutritious diet, &c.

CHAPTER XVIII.

IRRITANT GASES.

The chief are chlorine, sulphurous-acid gas, nitrous-acid gas, hydrochloric-acid gas, and ammonia. When diluted, they produce their injurious effects by absorption, which rapidly takes place from the mucous membrane of the pulmonary tissue. They cause death by their poisonous qualities, and not merely by producing asphyxia.

Chlorine.—This gas has a greenish-yellow colour, and a powerful suffocating odour. It is used to fumigate buildings, being a valuable disinfectant. Chlorine is employed by the calico-printer and paper-maker for its bleaching properties. The men who work in an atmosphere impregnated with it, suffer from dyspepsia, and *lose flesh. Any attempt* to inspire chlorine in its *concentrated state would* at once prove fatal by closing the

glottis, and causing asphyxia. When diluted, it excites excessive irritation of the air-passages, cough, difficulty of breathing, and inflammation.

In poisoning by chlorine, or any other of the irritant gases, our treatment must consist in the removal of the sufferer to pure air. Then the cautious inhalation of ammonia, sulphuric ether, or the vapour of warm water, will be useful.

Sulphurous-acid Gas is one of the products formed by the combustion of coal. It possesses bleaching and antiseptic properties; and is very irritating when inspired.

Nitrous-acid Gas is a very violent poison when inhaled, producing inflammation of the lungs, &c. It has proved fatal in several instances.

Hydrochloric-acid Gas is irrespirable in its concentrated state; and when diluted, produces great irritation of the lungs and air-passages.

Ammonia.—It has been already noticed (p. 28) that the vapour of ammonia is poisonous, exciting inflammation of the larynx, bronchitis, and pneumonia. Serious symptoms have sometimes arisen from its indiscriminate application, in cases of syncope, &c.

II.—NARCOTIC POISONS.

CHAPTER XIX.

OPIUM.

Opium is the inspissated juice of the unripe capsules of the papaver somniferum, or white poppy, and is a very compound substance. Its principal properties, however, are due to the presence of *morphia* and *meconic acid* in a state of combination, forming meconate of morphia.

It is sometimes used as a poison in its crude state, but more frequently in solution in alcohol, forming tincture of opium or laudanum. Unfortunately, opium is the powerful ingredient of most soothing syrups for children. The ill-effects produced by these mischievous preparations will be understood, when it is stated that of one hundred and ninety-eight deaths caused by opiates in the years 1837-38, no less than sixty-four occurred in children; forty-one of which were ascribed to over-doses of medicines or cordials, administered by mothers and nurses.

The chief preparations of opium in the London Pharmacopœia are:—The tincture, or laudanum, which contains one grain in nineteen minims; the vinum opii of the same strength; the compound tincture of camphor, or *paregoric*, which has two grains in the ounce; the enema *opii, having a grain* and a half in four ounces of fluid *starch; the liniment* of opium, with six grains in the

ounce; the confection, having one grain in thirty-six; the compound soap pill, and the compound styrax pill, each containing one grain in five; the ipecacuanha and squill pill, half a grain in ten; the compound ipecacuanha (or Dover's) powder, one grain in ten; the compound chalk and opium powder, one grain in two scruples; and the compound Kino powder, which has one grain in one scruple. Of domestic quieting physic the chief preparations are Godfrey's cordial, supposed to consist of one grain of opium in two ounces; and Dalby's carminative, which is one-fourth weaker.

The smallest quantity of *laudanum* which is known to have proved fatal to an adult, is two drachms (equivalent to $6\frac{1}{2}$ grains,) from which death occurred within twelve hours; but two grains and a half of the *extract*, a quantity said to be equal to four grains of crude opium, have produced a similar result. Much larger doses are, however, taken with impunity on many occasions; more especially by those habituated to the use of this drug, who remain almost unaffected by surprisingly large quantities. De Quincey, the English opium-eater once found in a pirated edition of Buchan's *Domestic Medicine*, a caution against taking more than "twenty-five *ounces*" of laudanum at one dose. He says that he always bore this *excellent* advice in mind; and it does not appear that he ever took more than sixteen ounces of the tincture of opium as his daily allowance. In certain diseases, patients quite unaccustomed to the use of sedatives can take excessive amounts without narcotism being produced. In some cases of tetanus, for example, upwards of four ounces of laudanum have been given daily for a week, without any marked effect.

On the other hand it must not be forgotten that not a few individuals are unable to take even one-third of a grain without becoming narcotised. Young children, too, are particularly susceptible of its effects; the tenth and twelfth parts of a grain having respectively proved fatal to infants two and five days old. Dr. Edward Smith.

has even recorded the case of an infant (*Medical Times and Gazette*, April 15th, 1854,) seven days old, who died comatose eighteen hours after having had administered to it about the twentieth of a grain of opium, or the quantity contained in one drop of laudanum.*

The duration of a fatal case is generally from seven to twelve hours. The shortest period recorded is three-quarters of an hour; the longest, forty-eight hours.

The quantity of MORPHIA found in opium varies from two to ten per cent. The chief salts of this alkaloid are the *acetate* and the *hydrochlorate*, both being very energetic poisons. The officinal solutions consist of one grain to the drachm. They cause symptoms similar to those about to be described as produced by opium. But, in addition, there has been especially noticed great itching of the skin, convulsive twitchings of the muscles of the face and limbs, and occasionally tetanus. Small doses of either of the salts of morphia may cause death. In a delicate woman half a grain is supposed to have proved fatal; and certainly a dose of two grains might kill a healthy adult unaccustomed to opiates. Nevertheless, under the influence of custom, large quantities may be taken. A young lady, who has long been under my care, has for the last three years taken daily fifteen grains of the hydrochlorate of morphia, without obtaining more than two or three hours sleep from it; while, for many days in succession, when suffering much pain, she increases the quantity to one scruple. From attempts to diminish the dose, made without the patient's knowledge, only mischief has resulted.

Symptoms.—When a large dose of opium or its tincture

* Considering the reprehensible way in which pseudo-medical advice is given in some newspapers and cheap periodicals, it is only surprising that more cases of poisoning do not occur. Take the following example (*Sunday Times*, 3rd October, 1847), of a cure for dysentery: "Half a noggin of logwood, well boiled and *strained, half a glass of* port wine, and twenty drops of laudanum, *have proved successful* in checking dysentery in adults. For *children only fifteen drops of* laudanum should be used."

has been taken, the symptoms usually manifest themselves in about twenty or thirty minutes. They commence with giddiness, drowsiness, and stupor; and then ensues insensibility. The patient appears as if in a sound sleep, from which he can be roused by a loud noise, &c., although he quickly relapses. As the poisoning progresses, the breathing becomes slow and stertorous, the pulse weak and feeble, and the countenance livid. The eyes are closed; while the pupils are generally contracted, often almost to the size of a pin's point, and insensible to the stimulus of light. In some instances the skin is cold and livid; in others, it is bathed in sweat. So also the countenance may be either ghastly, or placid; the pupils may be dilated; and the pulse may be unaffected, or so small and frequent as to be scarcely appreciable. Vomiting sometimes occurs, with slight reaction; so that hopes of recovery are entertained. But frequently there is a relapse, the comatose state returns, and death quickly follows, occasionally preceded by convulsions.

The possibility of rousing a patient during the progress of these symptoms will assist in diagnosing the effects of poisoning by opium, from those due to apoplexy, epilepsy, &c. When permanent recovery ensues it is complete; but it is usually preceded for a day or two by severe nausea, a sense of weariness, constipation, and headache.

The habitual use of opium is most injurious. Dr. Oppenheim in his description of the state of medicine in Turkey, tells us that persons seldom attain the age of forty who have begun the practice early. The opium-eater may be known by his attenuated body, withered yellow countenance, stooping posture, and glassy sunken eyes. He has no appetite; his bodily powers are destroyed; and he is obliged continually to increase the dose of his "grief-assuaging remedy" to obtain the wished-for effect.

Post-mortem Appearances.—The appearances in acute poisoning by opium are not very characteristic. The most prominent are, great turgescence of the vessels of *the brain,* with effusion of serum into the ventricles and

at the base. The turgid condition of the vessels often continues down the spinal cord, &c. The lungs are usually gorged with fluid blood; and the skin is of a livid hue.

Treatment.—The first object is to remove all the poison from the stomach, and this cannot be effected in any way so well as by the stomach-pump. In the absence of this instrument, emetics of half a drachm of sulphate of zinc, or a table-spoonful of mustard, must be employed; being administered as enemata, if there is inability to swallow. The patient at the same time is to be prevented as much as possible from going to sleep. When the stomach has been thoroughly emptied, every means must be adopted to keep the patient roused. This is to be effected by dashing cold water over his head and chest, walking him quickly up-and-down between two attendants in the open air, irritating his legs by flagellation with a wet towel, applying electro-magnetic shocks to the spine, and administering strong coffee. If there is much depression, alcoholic stimulants are to be given. Bleeding has been recommended; but it is only to be used after the poison has been removed from the stomach, and when from the coma and full pulse we are sure that there is cerebral congestion. In extreme cases artificial respiration must be tried.

The remedies recommended must be perseveringly used; remembering that as long as life lasts, hope of recovery is not to be banished. In the great majority of cases the treatment is successful.

Tests.—There are no direct means by which opium may be detected. We endeavour therefore to obtain evidence of the presence of morphia and meconic acid.

Morphia.—The best tests for this alkaloid, in substance or in solution, are :—1. Nitric acid, which slowly produces an orange-red colour. 2. Perchloride of iron (sesquichloride), which strikes a rich blue colour when *added in a small* quantity. This blue is destroyed by *acids, and by heat.* Nitric acid not only destroys the

blue produced by this test, but replaces it with the orange-red colour. 3. Iodic acid. This acid becomes decomposed, owing to the morphia combining with its oxygen, and setting free the iodine. The latter is detected by its brown colour, and the blue which it strikes with starch. The iodic acid should be previously tested to ascertain its purity, as it occasionally contains free iodine.

Meconic Acid.—This is obtained from solutions of opium, in the form of little scaly crystals of a reddish tint, which are decomposed by heat and partly sublimed. In solution it may be detected by its acquiring a cherry-red colour on the addition of the perchloride of iron.

CHAPTER XX.

HYDROCYANIC ACID—(*Prussic Acid.*)

PRUSSIC ACID, on account of its energetic and rapid action, is one of the most formidable poisons with which we are acquainted. In its concentrated state it is a limpid colourless liquid; possessing an acrid hot taste, and having an odour, when diffused through the air, somewhat resembling that of bitter almonds. When diluted with water, it forms the acid kept by the druggist. The properties of this variety are similar to those of the pure form; except that, if kept in the dark, it is not so readily decomposed. It is in this condition that it is used as a poison. The diluted acid of the London Pharmacopœia contains about 2 per cent., and that known as Scheele's from 4 to 5 per cent. of the strong acid.

One of the salts of hydrocyanic acid, the *cyanide of potassium*, claims a short notice, since it is largely employed by photographers, workers in electrotype, &c.

It has been taken as a poison. This salt is sold in the form of deliquescent white crystals, which are very soluble in water, and possess the odour of prussic acid. From three to five grains will destroy life as rapidly as prussic acid itself, and in the same manner: a dose of five grains has proved fatal.

Several vegetable substances yield prussic acid, such as the leaves and kernels of the peach, apricot, nectarine, cherry, &c.; the leaves of the laurel; and the pips of apples and pears. Cases of alarming illness have occurred from eating *bitter almonds* too freely; while the essential oil, obtained by distilling the pulp of these almonds with water, is a powerful poison. This *essence* or *oil of bitter almonds* contains about ten per cent. of anhydrous prussic acid; and it is probable that from ten to thirty drops would prove fatal to an adult.

A distilled water obtained from the leaves of the cherry laurel has been used as a poison. In the well-known case of Sir Theodosius Boughton, poisoned by Captain Donellan in 1781, *laurel water* produced death within half an hour of two ounces being swallowed; a quantity equivalent to fifty minims of Scheele's hydrocyanic acid.

A yellow coloured compound, made from the rectified products of coal tar and nitric acid, and known as *nitro-benzol*, is sometimes used as a substitute for essential oil of almonds. It is sold to perfumers under the name of essence of mirbane. A lad employed in some chemical works in the early part of this year (1862), finding a syphon did not act, sucked through it some of the fluid, which happened to be nitro-benzol. No immediate effect resulted, but in a few hours he felt as if he were drunk. Stupor came on, and ended in death twelve hours after swallowing the poison.—Another product of the destructive distillation of coal in gas-making is *aniline*; a colourless, limpid, acrid, and poisonous liquid. It *has an agreeable vinous* odour; and has given rise to *very alarming symptoms* when swallowed, as well a

when inhaled. The treatment is the same as that in poisoning by prussic acid.

The smallest quantity of prussic acid which has been known to destroy life, is nine-tenths of a grain of the anhydrous acid, equal to forty-five minims of the diluted preparation of the London Pharmacopœia; and it is probable that this would in most instances prove fatal. In this instance death occurred in twenty minutes; but from a larger dose, it has ensued much earlier. The period may be said to vary from two to five-and-forty minutes. In the case of the seven epileptics accidentally poisoned at the Bicêtre, death occurred in the first within twenty minutes, in the last after three-quarters of an hour, though the dose of the acid was the same in each instance.

Symptoms.—These will vary with the dose and the mode of exhibition. Inhalation of the vapour of anhydrous prussic acid would immediately cause death; while the vapour of the diluted acid has given rise to serious symptoms with great rapidity. Scheele is said to have been suddenly killed by respiring the vapour of the dilute acid while making his experiments.

When the diluted acid is taken in a large dose the symptoms may commence during swallowing, death following so quickly that scarcely any effects can be observed. The chief symptoms, perhaps, are insensibility, slow gasping respiration, a clammy cold skin, fixed and glistening eyes, dilated pupils, spasmodic closure of the jaws, an almost imperceptible pulse, and sometimes convulsions of the limbs and trunk. The rapidity with which consciousness is lost is well exemplified in an instance recorded by Hufeland, where a man about to be apprehended as a thief took an ounce of the acid, staggered a few steps, and fell apparently lifeless. In a few moments a single violent inspiration was made, and within five minutes of taking the poison he was dead.

Insensibility is not, however, in all instances, immediately produced; many an authenticated case having oc-

curred in which the symptoms were protracted for some minutes, the individual performing several acts indicating consciousness,—such as replacing the cork in the bottle, adjusting the bed-clothes.

The utterance of a shriek has been said to be characteristic of poisoning by this acid; but toxicologists know that such has not been observed in the human subject, and that there is merely a gasping for breath, or perhaps a call for help.

A small dose produces faintness, insensibility, difficulty of breathing, involuntary evacuations, loss of muscular power, convulsions, and sometimes paralysis. If the proper treatment be employed, recovery may often be effected.

Post-mortem Appearances.—The body is generally livid, the countenance natural, the jaws firmly closed, and the hands clenched. There is often an odour of prussic acid about the body, which is more perceptible on opening the stomach. The venous system is usually gorged with blood; and the brain, lungs, heart, liver, spleen, and kidneys have been found congested with dark-coloured fluid blood.

Treatment.—There is no antidote to this poison which can be relied upon. Chlorine and the mixed oxides of iron have been recommended; but even if one of these agents happened to be at hand, it is doubtful if its employment would be advantageous. Attempts must be made to restore animation by cold affusion, stimulating frictions to the chest and abdomen, warmth to the surface, and the application of ammonia to the nostrils. Cold affusion over the head and neck has proved the most efficacious, when promptly resorted to, and repeated at short intervals so as to cause a shock.

If recovery ensue from the immediate effects, vomiting should be produced by emetics; after which strong coffee, with brandy, ought to be administered.

Tests.—*The best* are the following:—

The peculiar *odour* of prussic acid is well known, and is very delicate.

Nitrate of silver yields a white clotted precipitate, (cyanide of silver,) soluble in boiling nitric acid. If this precipitate be dried and heated, cyanogen gas will be given off, which may be known by its burning with a purplish flame. This test is very delicate.

The Iron Test.—Saturate the suspected acid liquid with a few drops of potash, and then add a small quantity of a solution of sulphate of iron. A dirty greenish precipitate will fall. On adding a few drops of diluted sulphuric, or hydrochloric acid, Prussian blue will immediately be produced if hydrocyanic acid be present.

Sulphate of Copper added to prussic acid rendered slightly alkaline by potash, gives a greenish-white precipitate, which becomes white by the addition of a few drops of muriatic acid.

CHAPTER XXI.

CHLOROFORM. ÆTHER. AMYLENE.

THE anæsthetics which have hitherto been employed in the practice of medicine are chloroform, sulphuric ether, and amylene. Either of these agents may cause death when introduced into the system by inhalation, or when taken into the stomach in the form of a draught.

CHLOROFORM.—A colourless, heavy, volatile liquid; having a fruity æthereal odour, and a sweet pungent taste. It is formed by the union of equal volumes of chlorine and olefiant gas; and is readily soluble in alcohol, but very sparingly so in water. Chloroform is a good solvent of caoutchouc, gutta percha, camphor, wax, resin, some of the alkaloids, &c.

The symptoms produced by the vapour of chloroform

are complete insensibility and narcotism, with relaxation of the muscular system. At first the patient is conscious of all that is passing around him, but there is dizziness and singing in the ears. Then the mental functions are impaired, there is often excitement, the saliva is increased, the patient pushes away the inhaler, rigidity and spasms of the muscles may occur, and there is incoherent talk. In the next stage there is insensibility to pain, and the conjunctiva may be touched without causing flinching. If the use of this anæsthetic be pushed further, the breathing becomes stertorous, the muscles quite relaxed, and the pupils dilated; while a still further increase of the chloroform embarrasses and then stops the breathing, and arrests the heart's action.

Many cases of death from the vapour of chloroform have occurred; the fatal event sometimes happening very rapidly from shock, syncope, or convulsions. The vapour of only thirty drops has destroyed life in one minute.

The effects of chloroform taken by the mouth are of the same description as those which follow the poisonous inhalation of this agent; with this exception, that the fatal result seems to be longer deferred. A case lately reported (*Medical Times and Gazette*, 10th May, 1862), illustrates the symptoms, &c., in a clear way. Mr. M., thirty-four years of age, a highly-gifted restless man, was in the habit of inhaling chloroform on account of sleeplessness. He was very sensitive to its action. At about half-past twelve a.m. on the 7th October, 1861, he drank some chloroform; the quantity being uncertain, though it may be inferred that it was about one ounce. At a quarter-past seven he was in such a profound sleep that his wife felt uneasy, and she sent for Dr. Axel Lamm. This gentleman found his patient in a tranquil sleep, the respiration being somewhat hurried and audible, the pulse full but slow, the body warm, and the pupils *dilated and insensible*. There was a perceptible smell of *chloroform in the breath* and in the air of the room. The

window was opened, ice was applied to the head, cold affusions were used along the spine, and an enema was administered. At half-past nine, a.m., the patient was paler, breathing less audibly, and with a weaker pulse. Artificial respiration was employed by means of electricity, an ammonia lavement was given, and aspersions of ice water to the chest and pit of stomach were used alternately with warm coverings. The stupor continued, the respired air smelt distinctly of chloroform, the abdomen was tympanitic, and the pupils began to contract. About nine p.m. the eyes began to move, the pupils seemed sensible to light, the pulse was 160, there was abundant perspiration, and the patient sat up for a few moments and looked surprised. Exhaustion, however, set in; and death occurred just before midnight, nearly twenty-four hours after swallowing the poison.

A second interesting case (*Medical Times and Gazette*, 31st May, 1862), also deserves attention. A gentleman, fifty years of age, swallowed two ounces of pure chloroform at eight o'clock a.m. He was not seen until three p.m., when he was found in a state of doep coma. His breath smelt strongly of chloroform, the pupils were widely dilated and insensible, the pulse slow and feeble, the surface colder than natural, the movements of the thorax scarcely perceptible, and sensation generally abolished. Ammonia, sinapisms, bottles of hot water, and cold affusion did no good; but on using the stomach-pump, a quantity of chloroform mixed with watery mucus was withdrawn, and in less than an hour the patient was able to answer questions. For three or four days he complained of a burning sensation in the throat and epigastrium, and then got well.—A consideration of the treatment employed in this instance cannot but suggest the idea that the first patient might have had a better chance of recovery had the stomach-pump been used *when Dr.* Lamm was first called in; though it is difficult *to conceive* how any quantity of chloroform could remain

in the stomach for seven hours, without all of it being absorbed.

In the *treatment* of poisoning by the vapour of either of the anæsthetics mentioned in this chapter, we must expose the patient to a current of pure air, use cold affusion, and employ artificial respiration until the poison is eliminated. As these agents are got rid of through the lungs, the purity of the expired air is one test of the elimination being complete; though of course inferior to the evidence afforded by the subsidence of the symptoms. In poisoning by liquid chloroform or ether, the stomach-pump ought to be promptly used.

SULPHURIC ETHER.—Sulphuric ether, or ether, is a clear colourless liquid, very inflammable, soluble in alcohol, and less so in water. It is usually obtained by distilling common alcohol with sulphuric acid.

The effects produced by the inhalation of ether are similar to those which result from chloroform. It is, however, without doubt a much safer agent; and many have remarked that the sensations caused by it are more pleasant.

AMYLENE.—This is a colourless, volatile liquid; made by distilling amylic alcohol (obtained from crude fusel oil, or oil of potato spirit) with chloride of zinc.

Dr. Snow found that amylene, like chloroform, is capable of causing sudden death by inducing over-narcotism of the heart, and paralysis of this organ. He seems to have administered it to 238 patients, and to have had two deaths from it.

CHAPTER XXII.

ALCOHOL.

Spirituous liquors, when taken in large quantities, *have produced fatal effects*; usually after giving rise to *the symptoms of* apoplexy.

Two wineglassfuls of brandy proved fatal to a boy, seven years old, in thirty hours. Dr. Taylor mentions the case of a man who drank two bottles of port wine (containing eleven ounces of alcohol) in less than two hours. He speedily became intoxicated and utterly helpless, never rallied, and died from congestion of the brain and lungs. Another man who swallowed a bottle of gin for a wager died in half an hour; although much of the spirit was removed by the stomach-pump.

The *symptoms* generally come on rapidly, the individual appearing confused, and unable to walk steadily. This degree of intoxication soon passes into the stage of complete stupor and coma; and unless there is vomiting collapse soon sets in. In some cases a remission of the symptoms has occurred; death being postponed for a day or longer.

As the alcohol is eliminated by the lungs, stupor from drink may be detected by the odour of the breath. The countenance is also flushed, and the pupils are dilated; instead of the face being pale, and the pupils contracted, as in poisoning by opium. Moreover, the individual may generally be roused for a few moments by a loud noise, &c.; a circumstance which may prevent intoxication being mistaken for concussion of the brain.

Diluted spirits produce a state of excitement, terminating in stupor. It must be remembered that alcoholic liquids have been frequently made the vehicles of more virulent poisons.*

As regards *treatment* it is only necessary to say that the poison is to be removed as quickly as possible by the stomach-pump. Cold affusion should be employed, and the diluted liquor ammoniæ acetatis administered. Subsequently warmth must be promoted.

* For the effects, &c., of chronic poisoning by alcohol, the reader is referred to the author's *Manual of the Practice of Medicine*, 4th edition, p. 220.

CHAPTER XXIII.

HENBANE. LETTUCE-OPIUM. NIGHTSHADE.

THESE are not important substances, as they have rarely been employed as poisons. Serious symptoms have, however, resulted from their accidental use.

HENBANE (*Hyoscyamus niger*). — All parts of this plant are poisonous; but the seeds are more powerful than the root or leaves. In medicinal doses it is a feeble narcotic; but I believe the virtues of this drug are generally over-rated. It owes its powers to an alkaloid (*hyoscyamia*) it contains.

In very large doses henbane produces giddiness, flushings, excitement, and a sense of weight in the head; the limbs tremble, and there is general loss of power; while the pupils get dilated, there is double vision, flashing of light before the eyes, and great drowsiness. If vomiting supervene these symptoms generally pass off; otherwise we may find fierce delirium, loss of speech, complete paralysis, cold sweats, and exhaustion.

In some instances when the roots have been eaten by mistake for parsnips, the symptoms have been those of drunkenness and delirium. Dr. Houlton states (*Lancet*, 6th July, 1844) that this error was committed one night at a monastery. The monks who partook of the roots had such hallucinations, that the establishment resembled a lunatic asylum. They rang the bell for matins at midnight; and those who attended were unable to read, or they read that which was not in the book.—In another reported case (*Edin. Med. and Surg. Journal*, p. 562, October, 1844), the roots were put into soup, of which nine persons partook Although no unpleasant flavour was noticed at the time of eating, yet very shortly *afterwards all com*plained of an acrid taste, nausea, in*distinctness of vision*, restlessness, delirium, and great *somnolency, which* continued some time.

The appearances found after death consist chiefly of great congestion of the venous system. The lungs and brain have especially been found loaded with dark-coloured blood.

To prevent a fatal result from the use of henbane, lettuce-opium, or nightshade, we must trust to emetics and full doses of castor oil.

LETTUCE-OPIUM.—Both the Lactuca Sativa and Virosa contain a feeble narcotic principle. Their inspissated juice, known as *Lactucarium* or *Lettuce-opium*, is sometimes used to induce sleep. No case of poisoning by this substance is known.

NIGHTSHADE.—The *Solanum Dulcamara* (Bitter-sweet, or Woody-nightshade) and the *Solanum nigrum* (Garden-nightshade) contain an active principle known as Solania. The red berries of the first-named plant, and the black berries of the second, have been eaten by mistake; and have given rise to great thirst, headache, giddiness, dimness of vision, dilated pupils, convulsions, vomiting, and purging. Orfila relates the cases of three children who died from eating the berries of the Solanum nigrum, after suffering from vertigo, dilated pupils, nausea, colic, stertorous breathing, and convulsions.

CHAPTER XXIV.

NARCOTIC GASES.

THE most important of these noxious gases are the carbonic acid, sulphuretted hydrogen, and carburetted hydrogen.

CARBONIC ACID GAS.—This heavy inodorous gas is the cause of numerous accidents, owing to the variety of sources from which it is produced. It is formed from *burning fuel*, from the calcination of limestone or chalk, *and it is* a product of respiration. It is diffused through

wells, coal-mines, and caverns. During fermentation it is largely given off. The vapour of charcoal owes its poisonous properties to carbonic acid gas, as does that arising from lime and brick-kilns.

In this country suicides rarely resort to carbonic acid gas to accomplish their ends: in France they very frequently do so.

Symptoms.—In its pure state this gas causes death by asphyxia, the glottis becoming spasmodically closed the moment the vapour comes in contact with it. When sufficiently diluted to be inspired, it acts by absorption; giving rise to giddiness, headache, vomiting, a tendency to sleep, and loss of muscular power. The heat of the body is not lowered, and the limbs are usually flexible. The countenance gets livid, the respiration becomes hurried and stertorous, and complete insensibility ensues; while the heart's action, which was at first rapid, soon ceases.

Post-mortem Appearances.—The body is generally swollen and livid, especially about the face. The countenance is not always bloated, sometimes being calm and pale. The limbs are often rigid, the skin is marked with livid patches, and the abdomen is distended with gas. The right cavities of the heart, the lungs, and large veins, are found gorged with venous blood: while the brain and its membranes are usually very vascular, and occasionally there is serous effusion.

Treatment.—Prompt removal to the pure air, cold affusion, and stimulating applications to the chest and extremities, are the best means for resuscitation. If the countenance is bloated, venesection may be performed. Artificial respiration, galvanism, and the inhalation of oxygen gas, have been found useful.

Sulphuretted Hydrogen.—This gas is a very active poison; but, from its offensive odour (resembling that of rotten eggs), it is not so liable to be accidentally inhaled as the carbonic acid. It is usually met with combined with other gases, as the hydrosulphate of am-

monia, &c., resulting from the putrefaction of feculent matter. When breathed in a diluted state, it speedily produces insensibility and death. Workmen long engaged in drains and sewers, or in any atmosphere contaminated with sulphuretted hydrogen gas, suffer from giddiness, nausea, and weakness: these symptoms ending at length in low fever, which is often fatal.

In acute cases there will be little hope of recovery, unless the individual can be quickly removed into the open air, and stimulants, &c., applied. Chlorine gas, well diluted with common air, should be employed, as it acts as an antidote to this poison.

CARBURETTED HYDROGEN (*Coal-gas*).—The symptoms produced by this gas, when mixed with air and inhaled, are those of asphyxia. If the person breathing it should be roused before a fatal quantity has been inhaled, the chief effects may be intense headache, laboured and oppressed respiration, fiery scintillations, quickened action of the heart, sickness, and great loss of power.

In 1841, a family in Strasburgh were poisoned by being in an atmosphere contaminated with coal-gas, for forty hours. Of the six members four were found dead; while the father died in twenty-four hours, but the mother recovered. The gas escaped from a pipe which passed under the cellar of the house where this family resided; so that it probably poisoned the air gradually, and gave rise to no suffering to warn the unfortunates.

NARCOTICO-IRRITANT POISONS.

CHAPTER XXV.

NUX VOMICA, BRUCIA, AND STRYCHNIA.

THE plants which yield the alkaloid strychnia, are the *Strychnos Nux Vomica*, a native tree of Coromandel, Ceylon, and Bengal; the *Strychnos Ignatii*, which abounds in the Philippine Islands, and furnishes the hard seed, about the size of a filbert, known as the bean of St. Ignatius; the *Strychnos Tieute*, a large climbing shrub of Java; the *Strychnos Toxifera*, of Guiana; and the *Strychnos Colubrina*, or *Snakewood*, of the East Indies. The effects of these plants are exerted upon the spinal cord; as is manifest by the violent convulsions and the tetanic contractions of the muscles which they produce. They have no effect on the brain, consciousness remaining intact until death.

A powerful juice, used by the Indians as an arrow-poison, and variously designated as curara, woorara, ticunas, &c., was formerly thought to be obtained from the strychnos toxifera. But recent investigations seem to show that this extract is a mysterious compound of many substances obtained from plants, red and black ants, and the fangs of a venomous snake. It destroys the power of the motor nerves—an action the reverse of that possessed by strychnia.

NUX VOMICA.—A powder, a tincture, and an extract, obtained from the seeds of the strychnos nux vomica, or koochla tree, are used in medical practice. Thirty grains of the powder have proved fatal, and so have *three* grains of the alcoholic extract. Death may occur *in from fifteen minutes* to twelve hours. It is probable *that nux vomica* accumulates in the system, as serious *symptoms have* arisen from the long-continued use of

small doses. Thus, a lady took nine grains of the powder daily, in divided doses, for sixteen days. As purging then set in with colic, the medicine was withdrawn. Five days after the withdrawal there was ringing in the ears, with drowsiness, impairment of speech, &c.; on the ninth day tetanic symptoms set in, and trismus; and on the twelfth day, after several tetanic convulsions, death took place from exhaustion.

BRUCIA.—The seeds of the nux vomica not only yield strychnia but brucia; an alkaloid which has the same properties, and causes the same symptoms as strychnia, though it is much less powerful.

STRYCHNIA.—This alkaloid may very justly be termed a deadly poison. When employed in medicine so much caution is necessary, that its use seems scarcely justifiable. It is unfortunately the active ingredient of some preparations sold to the public for destroying vermin; a circumstance which has now led to the death of several children. "Battle's Vermin Killer" is said by Dr. Letheby to consist of flour, Prussian blue, sugar, and strychnia in the proportion of 23 per cent. Since the use of strychnia by those notorious criminals Palmer and Dove, this formidable agent has been employed by other murderers.

The medicinal dose of strychnia is from the $\frac{1}{30}$th to the $\frac{1}{15}$th of a grain twice a day. Dr. Christison communicated a case to Dr. Taylor in which the $\frac{1}{16}$th of a grain caused the death, in four hours, of a child between two and three years of age. One quarter of a grain has nearly proved fatal to adults. A woman, twenty-two years of age, died in the Jersey Hospital, from the accidental administration of half a grain. Death has occurred in twenty minutes from this poison. In eleven cases analyzed by Dr. Guy, two hours and three quarters were the limits.

Symptoms.—The time at which the symptoms commence varies according as the strychnia is taken in solution or in a pill. In the first case a hot, bitter taste is experienced during swallowing, usually followed in a *few minutes* by a sense of suffocation and difficulty of *breathing*. Then there are twistings of the muscles,

jerking movements of the limbs, and a quivering of the whole frame. The limbs become rigid, the head is bent back, while the body is stiffened and arched, so that it rests on the head and heels (opisthotonos). The difficulty of breathing causes the face to become dusky, the eyeballs prominent, and the lips livid. The features assume a peculiar grin (risus sardonicus); there is much thirst, but perhaps inability to drink from spasm of the jaws; while the sufferer is quite conscious, is much alarmed, and is impressed with the idea that death is surely stealing upon him. As the attacks of spasms are commencing the patient cries out, and warns those about him of the approach of the seizure; he begs for help, and perhaps asks to be held, or rubbed, or turned over; and when the seizure passes off, at the end of forty or sixty seconds, he is exhausted, and bathed in sweat. The more he is disturbed or excited, the shorter is the interval between the attacks; and though a firm grasp seems to afford relief, yet a slight touch, a gust of air, or opening a door, will increase the suffering. As death approaches the tetanic spasms rapidly succeed each other; and the patient sinks, suffocated or exhausted, in about two hours from the beginning of the symptoms.

When the strychnia has been taken in a pill, two hours have elapsed before any effects have been produced. A case is also reported (*Glasgow Medical Journal*, July, 1856) where a medical man took three grains of strychnia dissolved in spirits of wine and diluted sulphuric acid. He went to bed and slept for an hour and a half, and then awoke with a spasm. Under treatment he recovered.

There is commonly a wide difference between tetanus arising from a wound or from disease, and that provoked by strychnia. In the former case some exciting cause can be detected; the symptoms come on gradually, and *only attain* their full development at the end of several *hours; the rigidity* of the muscles is more or less *permanent, there being* no intervals of relaxation as there *are in poisoning;* and death has hardly been known

occur in less than twenty-four hours, while frequently it is deferred for two or three days.

Post-mortem Appearances.—Although the body is relaxed at the time of death, it quickly stiffens—frequently in the course of ten or fifteen minutes. The rigor mortis is persistent for some time: in the case of Cook, poisoned by Palmer, the rigidity of the body and limbs had not passed off after two months' interment. The hands are often clenched, and the soles of the feet arched and inverted. There is lividity of different parts. The membranes of the brain, and of the upper part of the spinal cord are congested; and there is often great serous effusion under the spinal arachnoid. The lungs are generally loaded with dark fluid blood. The heart is flaccid, and the right cavities distended like the pulmonary vessels. The blood is everywhere liquid.

Treatment.—Emetics are to be given at once, and repeated until very free vomiting is induced. If the tetanic spasms have not commenced, the stomach-pump ought to be used. When the patient is unable to swallow, a drachm of sulphate of zinc, or a couple of ounces of ipecacuanha wine, should be injected into the rectum. Then an ounce or two of castor-oil, perhaps with a couple of drops of croton oil, is to be administered. Fatty matters appear to retard the absorption of this poison.

Iodine forms a crystallizable compound with strychnia. Dr. Bennett, of Sydney, has recorded an instance in which he attributed recovery to the employment of tincture of iodine. Hence from thirty minims to a drachm of this tincture may be exhibited. In its absence, three or four ounces of animal charcoal, diffused through water, ought to be given.

To prevent the spasms, by paralysing the motor nerves, a solution of woorara (as recommended by Dr. Harley) might be injected under the skin; or if it could be obtained, the active principle of this substance, *curarina*, would perhaps be deserving of trial.

The patient is to be kept warm, and sweating induced if possible. While if the tetanic spasms continue, the vapour of chloroform will at least tend to diminish the suffering.

Tests.—Strychnia is a white crystalline solid, very insoluble in water, soluble in alcohol or chloroform or weak acids, and having an intensely bitter taste. Pure strychnia is not changed in colour when treated with iodic acid or with either of the strong mineral acids; but as this alkaloid generally contains brucia, nitric acid reddens it. Dissolved in sulphuric acid no change ensues; but on adding a fragment of bichromate of potash to the solution, a series of blue, violet, purple, and red tints are produced.—If the skin of a frog be dried, and a few drops of a solution containing strychnia applied to it, strong tetanic convulsions will ensue, and be reproduced every time the animal is touched or irritated. According to Dr. Marshall Hall this strychnoscopic test will detect the $\frac{1}{8000}$th of a grain, or even less.

CHAPTER XXVI.

BELLADONNA. ACONITE. STRAMONIUM. COLCHICUM. HELLEBORE.

ATROPA BELLADONNA (*Deadly Nightshade*).—Two plants known under the name of Nightshade have already been described (p. 75). The Deadly Nightshade, now to be noticed, is indigenous, and grows in woods and gardens. The root, leaves, and berries are poisonous; this property being due to the presence of an alkaloidal principle—*Atropia*. The officinal preparations of belladonna are the extract, which is usually *administered* in doses of gr. $\frac{1}{8}$ to gr. $\frac{1}{4}$; the tincture, of *which from* m. v *to* m. xx may be given; and the plaster *and ointment for* external use.

Symptoms.—Dryness of the mouth and throat, thirst which nothing allays, nausea and vomiting, great dilatation of the pupils with indistinct vision, giddiness, palpitation of the heart, physical and mental depression, perversion of the sense of taste, and delirium followed by coma, form the chief symptoms. They may set in within from half an hour to three or four hours of swallowing the poison. Sometimes strangury and bloody urine, a scarlatinal kind of rash upon the skin, a disposition to laugh and talk wildly, fanciful delusions, a rapid flow of ideas, and difficulty in walking, have been observed.

A large detachment of French soldiers, halting near Dresden, ate freely of the belladonna berries. Shortly afterwards they were seized with nausea, thirst, dryness of the throat, difficult deglutition, insensibility of the eye, great dilatation of the pupil, delirium, and coma. Many of the men died before assistance could be rendered to them.

Post-mortem Appearances.—Congestion of the cerebral vessels, dilated pupils, red patches at different parts of the alimentary canal, and a dyed purple hue of the gastric mucous membrane, are the most common appearances.

Treatment.—Emetics, castor oil, and animal charcoal are the remedies to trust to.

Dr. Taylor refers to one case in which a young man poisoned himself with two grains of *atropia*. He took the dose on going to bed, was heard to snore heavily during the night, and was found dead at seven o'clock in the morning.

ACONITE (*Aconitum Napellus, Monkshood, Wolfsbane*). —This beautiful plant is found in most parts of Europe. The two Pharmacopœial preparations of it are the extract (dose gr. i to gr. iv), and the tincture (m. ii to m. v).

Aconitina, the alkaloidal base of this plant, is the most *deadly poison* known; the fiftieth part of a grain having *nearly caused* death.

The chief *symptoms* of poisoning by aconite are numbness and tingling in the mouth and throat, giddiness, abolition of muscular power, pain in the abdomen, with vomiting and purging. Sometimes delirium and slight stupor have been noticed. The pupils are dilated, the skin is cold, the pulse feeble, the breathing oppressed, and there is a dread of approaching dissolution. Frequently the sufferer is perfectly conscious, till death suddenly occurs after two or three hurried gasps. According to Dr. Fleming death may be due to a sedative impression on the nervous system, or to asphyxia from paralysis of the respiratory muscles, or to syncope.

A fatal mistake is not very uncommonly made in eating the root of aconite for that of horseradish. The sense of tingling and numbness produced by the former, is so different to the pungent taste of the latter that it is difficult to account for the error.

Of the root one drachm, of the tincture one drachm, and of the alcoholic extract four grains, have caused death.

No time must be lost in the use of remedies. In addition to emetics, castor oil, and animal charcoal, benefit may be derived from administering strong coffee. Brandy or ammonia should also be given, while the limbs and back are well rubbed with hot towels. Artificial respiration might prove useful.

Stramonium (*Datura Stramonium, Thorn-Apple*).—An indigenous plant found in waste places. The fruit and seeds are the most poisonous. The active alkaloid, named *Daturia*, has properties resembling those of atropia. The Extractum Stramonii of the London Pharmacopœia is medicinally given in doses of gr. ½ to gr. ij.

The poisonous effects of stramonium are the same as those of belladonna, and are to be relieved by similar remedies. When this drug is prescribed as a medicine it *should be immediately* discontinued if it produce dryness *of the throat* and dilatation of the pupils. I have seen

unpleasant effects from smoking the leaves in a case of asthma; and alarming symptoms have been induced by their application to an extensive burn.

COLCHICUM (*Colchicum autumnale, Meadow Saffron*).—This plant grows in most damp meadows. Its noxious properties are due to the alkaloid *Colchicina*, which is allied to that contained in white hellebore (*Veratria*). In two instances less than half a grain of colchicina proved fatal to adults.

HELLEBORE.—Of the several species of hellebore two only require a few words of notice.

The *Black Hellebore* or *Christmas Rose* grows in shady woods, and bears a large flower in January. The leaves and root when eaten give rise to abdominal pain, vomiting and purging, vertigo, cold sweats, and collapse resembling that of malignant cholera. An infusion of this plant is sometimes administered by quacks to destroy intestinal worms. It has proved fatal to children under these circumstances.

The *White Hellebore* is a poisonous plant, sometimes employed to destroy lice in the hair. When taken internally it has caused violent sickness, purging, dilatation of the pupils, cold sweats, convulsions, and death. Its properties are due to *Veratria;* an alkaloid which may also be prepared from the seeds of the Asagræa officinalis, or Cevadilla Seeds.

Emetics, purgatives, and stimulants are the means employed to prevent death in poisoning by any of these vegetable substances.

CHAPTER XXVII.

DIGITALIS. TOBACCO. LOBELIA INFLATA. CAMPHOR.

DIGITALIS PURPUREA (*Purple Foxglove*).—The seeds, leaves, and root of this indigenous hedge-plant are *poisonous*. *Digitalia* is the alkaloid which these parts

contain. The officinal infusion of digitalis, made from the dried leaves, is used in doses of ℥ij, ℥ss, or more; of the tincture m. v to m. xl are usually given. On the recommendation of the late Mr. Jones, of Jersey, half an ounce of the tincture is sometimes administered in cases of delirium tremens; this dose being repeated a second or even a third time, in the course of six or eight hours.

Digitalis is very uncertain in its action. When given medicinally its effects should be watched, as it probably accumulates in the system. A poisonous dose seems to produce vomiting, purging, colic, headache, slowness and irregularity of pulse, dimness of vision, dilated pupils, lethargy, prostration, convulsions, and coma. In two instances death occurred within twenty-two hours. The appearances found afterwards have been chiefly congestion of the cerebral vessels, and slight inflammation of the stomach.

In addition to the administration of emetics and castor oil, some infusion containing tannin (*e.g.* the officinal decoction of gall-nuts, or tannic acid diffused in water), should be given as an antidote. Substances containing tannin render the digitalis inert. Strong tea or coffee, with brandy, will likewise be needed, to lessen the somnolency and exhaustion.

Tobacco (*Nicotiana Tabacum*).—All parts of this plant are very poisonous. An infusion of the leaves, exhibited as an enema, has, on several occasions, speedily proved fatal. Persons in attempting to acquire the habit of smoking often suffer from severe nausea, vomiting, great prostration, and insensibility; while in some instances, more severe effects have ensued. Symptoms very much resembling those of apoplexy have also been produced by the excessive use of snuff. Sauteuil, the French poet, died in fourteen hours, from swallowing *the contents* of his snuff-box, which had been mixed *with his wine*, as a joke.

Nicotina, the alkaloid of tobacco, is as deadly a

poison as prussic acid. It is an acrid, volatile, oily liquid, of a pale amber colour. In 1858 a chemist of rising reputation committed suicide with this substance. He was seen by one of the attendants at the Museum in Jermyn-street, in the act of falling forwards out of a water-closet in which he had concealed himself. The attendant raised him up, and with the aid of another man endeavoured to carry him to a table, but he heaved a deep sigh and died in their arms. The appearances afterwards found were great congestion of the membranes of the brain, and a dark fluid state of the blood.

LOBELIA INFLATA (*Indian Tobacco*).—This plant is a native of North America; and its powdered leaves and seeds have been much used as a remedy for asthma. In one instance, in which a quack prescribed a drachm of the leaves, pain, vomiting, unconsciousness, feebleness of pulse, and contraction of the pupils supervened; and death occurred in thirty-six hours. Ignorant impostors, calling themselves medical botanists, have poisoned several simple individuals, both in England and America, by physicking them with this mischievous and powerful drug.

CAMPHOR.—This substance is very variable in its action. It has given rise to alarming symptoms on some occasions, and once it has destroyed life. In scruple and half-drachm doses, it seems to have produced giddiness, dimness of sight, difficulty of breathing, delirium, and insensibility. In larger quantities it appears to act as a common narcotico-irritant.

The stomach pump or emetics must be employed. If the effects are not very severe, they will generally cease spontaneously.

CHAPTER XXVIII.

HEMLOCK. COCCULUS INDICUS. DARNEL SEEDS. LABURNUM. YEW.

CONIUM (*Conium Maculatum, Common or Spotted Hemlock*).—This indigenous plant, which grows abundantly in hedges and wild places, belongs to the order Umbelliferæ. The following common umbelliferous plants are likewise poisonous—viz., the *Cicuta virosa* or water-hemlock, the roots of which have been eaten in mistake for parsnips; the *Œnanthe crocata*, or hemlock water-dropwort, one of the most virulent of English vegetables; the *Æthusa cynapium*, or fool's parsley, sometimes gathered in mistake for parsley; and the *Phellandrium aquaticum*, or fine-leaved water-hemlock, popularly known as water-parsnip. They have all given rise to accidents.

The seeds, leaves, and root of the conium maculatum are all poisonous. The effects are rather variable, sometimes consisting chiefly of delirium, stupor, coma, and convulsions; on other occasions the action being chiefly exerted on the spinal cord, and hence producing death by apnœa from paralysis of the muscles of respiration.

The alkaloid of hemlock is a pale yellow, volatile, acrid, oily-looking liquid, known as *conia, conein*, or *conicina*. It is a potent poison, occasioning general paralysis without loss of sensibility.

COCCULUS INDICUS.—The kernel of the berry of the Menispermum cocculus or Levant nut, imported from the East Indies, contains from one to two per cent. of a poisonous alkaloid named *Picrotoxia*. Thieves sometimes mix a decoction or extract of the berries with *spirits or beer, to give* these drinks an intoxicating property *(hocussing)*. The symptoms produced appear to

be a peculiar stupor, a complete loss of voluntary power, with a consciousness of passing events.

DARNEL SEEDS.—(*Lolium Temulentum*).—The seeds, when accidentally mixed with wheat or rye, and ground into flour, have caused gastric pain, severe giddiness, vomiting, and other symptoms of intoxication. A wet season is said to encourage the growth of darnel with the varieties of corn.

LABURNUM (*Cytisus Laburnum*).—Every part of this common plant is poisonous, owing to the presence of the alkaloid *Cytisin*.

YEW (*Taxus Baccata*).—The leaves and berries of the yew-tree have been given to produce abortion or to act as a vermifuge. In many instances death has resulted, after the usual symptoms of a narcotico-irritant.

Emetics, castor oil, and stimulants are the means to be resorted to in poisoning by any of the foregoing substances. Cold affusion will often be useful, more especially if there be much stupor.

CHAPTER XXIX.

ERGOT OF RYE. POISONOUS FUNGI.

ERGOT OF RYE (*Spurred Rye, Secale Cornutum*).—The grain of wheat, barley, oats, and rye is apt to be attacked by a parasitic fungus named the Ergotætia abortifaciens. Ergotised grain, in full doses, gives rise to lassitude, headache, nausea, and diarrhœa. From small quantities, frequently repeated, gangrene of the extremities has resulted. The peculiar influence of ergot on the muscular coat of the uterus, renders this agent a valuable medicine when we wish to induce powerful contractions.

POISONOUS FUNGI (*Mushrooms, Champignons, Toadstools*).—According to the Rev. M. J. Berkeley (*Outlines of British Fungology*; containing characters of

above a thousand species of fungi, and a complete list of all that have been described as natives of the British Isles: London, 1860), there are now upwards of 2380 recognised species of British fungi. It is probable that only a small proportion of these are devoid of poisonous properties.

The *Agaricus campestris* and *esculentus* are the most frequently used as articles of food, on account of their savory properties; but even these are indigestible. They occasionally produce diarrhœa, with a pruriginous or exanthematous rash in dyspeptics; and should only be eaten in great moderation.

Ketchup, the juice of the mushroom flavoured with salt and spices, has produced faintness, nausea, and colic, lasting for some hours.

There are no positive characters by which the wholesome fungi can be distinguished from the unwholesome. Moreover, those which may be eaten with impunity by some individuals, prove destructive to others. Thus, a French officer and his wife died from breakfasting off mushrooms, which others in the house eat without inconvenience. As a general rule highly-coloured mushrooms, with an astringent styptic taste, a forbidding pungent odour, and which grow in dark shady places, should be avoided. The orange-coloured *Amanita muscaria* is especially to be shunned; although this fungus is eaten by many Siberian tribes, to produce excitement and intoxication.

The symptoms produced by poisonous fungi are those indicative of gastro-intestinal irritation, with a disordered condition of the nervous system, and considerable depression. The mischievous effects are thought to be due either to a volatile acrid principle, or to an uncrystallizable solid termed *amanitin*. In treating these cases, the stomach and intestines must be thoroughly emptied, and then the prominent symptoms are to be relieved according to their urgency.

APPENDIX.

I. Bites of Venomous Reptiles.—The poisonous reptiles provided with fangs are the ophidia or serpents. The chief foreign serpents which are poisonous are :— 1. The *Cerastes* or *Horned Serpents*, allied to the vipers, and much to be dreaded. 2. The *Crotali* or *Rattle Snakes*, provided with long poison fangs, and a reservoir of considerable size. These reptiles can destroy an ox or a horse almost instantaneously. In the human subject their poison produces an agonizing death in two or three minutes. 3. The *Bothrops* or *Javelin Snakes*, inhabitants of Martinique and St. Lucia. The most formidable species is the yellow viper of Martinique, which has frequently killed negroes at work in the plantations. M. Guyon saw several soldiers perish from its bite. Death may occur almost immediately, or in the course of twenty-four hours. And, 4. The *Naia*, or *Spectacled Serpents*, or *Hooded Snakes*, which are met with in Arabia and India. This group contains the coluber haje, the true asp of the ancients; and also the cobra di capello.

On the morning of the 20th October, 1852, one of the keepers at the Zoological Gardens in the Regent's Park, was wounded by a cobra, which he had removed from its cage, and was playing with. For twenty minutes after the animal bit him at the root of the nose no peculiar symptoms were manifested, and the part was merely bathed with water. Forty minutes afterwards the man was admitted into University College Hospital, his face then being livid, respiration impeded, and the power of *locomotion* imperfect. He pointed to his throat as the

seat of pain, but could not speak, and was unable to swallow. Artificial respiration was employed for fifty minutes, and subsequently galvanism; but stupor rapidly succeeded to faintness, and the patient died comatose fifty-five minutes after admission. The chief appearances found on dissection were an unnatural fluidity and blackness of the blood, with great congestion of the lungs and spleen.

The only poisonous reptile indigenous to this country is the *common viper* or *adder*. It is found on the heaths and in the dry woods of all parts of England, Scotland, and Wales; and is much feared on account of its venom. Very few cases are known in which the bite of this animal has proved fatal. Only recently (May, 1862), however, an instance has been recorded. A little boy, at Burgess Hill, near Brighton, clambered up a bank, to examine a bird's nest. Groping with his hand among the moss, he felt, as he thought, a sharp prick from a thorn. It turned out to be a bite from an adder. As the real cause of the wound was not suspected, the swelling of the hand and arm was not properly attended to until too late; and the poor child died on the second day.

The poison apparatus of the viper consists of a gland placed by the side of the head, a duct, and a fang or pointed curved tooth moulded in the form of a tube. On being bitten, the person has pain in the wounded part, which quickly becomes severe and extends up the adjoining tissues. The limb swells greatly, becomes red and livid; while faintness soon sets in, and the pulse gets rapid and small. Bilious vomitings, dyspnœa, profuse cold sweats, jaundice, delirium, and convulsions have also been noticed. In a few days the symptoms usually amend; but in weak sickly individuals gangrene of the limb may follow, or death may occur in the course of *two or three days*.

The treatment of the bites of venomous reptiles must *be local and constitutional*. Immediately the wound is

inflicted it should be sucked freely and perseveringly. If the patient is too faint to do this for himself, a by-stander may fearlessly help him; for it is well known that these poisons may be smeared upon the lips and tongue, or even swallowed, with impunity. At the same time a ligature is to be placed around the limb, above the wound; or if this be impossible from its situation, the textures around are to be compressed. Then, the bitten part may be excised; or it may be destroyed by the actual cautery, nitric acid, the strong liquor ammoniæ, or nitrate of silver.

The constitutional remedies are derived chiefly from the class of diffusible stimulants. No agent is more generally recommended than ammonia; and therefore the officinal compound tincture of ammonia (formerly known as eau de luce) should be given in half-drachm doses well diluted, or the aromatic spirits of ammonia may be administered in the proportion of two drachms to an ounce-and-a-half of water. Supposing that no ammonia is at hand, brandy will prove an excellent substitute. Transfusion of blood has been likewise recommended; but I do not know of any instance in which it has been resorted to.

II. Bites of Rabid Animals.—As the subject of Hydrophobia is fully treated of in my work on the Practice of Medicine, I shall here confine my remarks to the treatment to be adopted directly a person is bitten by a rabid animal. This is briefly as follows:—The tissues around the seat of injury are to be compressed by a ligature or otherwise to prevent absorption. Then the wounded part is to be excised as soon as possible; taking care to remove every portion touched by the animal's teeth, and to obtain a clean raw surface. The wound should then be thoroughly washed by a stream of water, long poured over it; and lunar caustic afterwards applied. Mr. Youatt prefers the nitrate of silver freely used, to every other caustic; and he also recommends that after its application the wound should be quickly

healed, though many authorities advise that it be kept open by irritating ointments. As these operations are very painful, there is no objection to the patient being placed under the influence of chloroform. He should afterwards be assured that everything has been done to prevent any subsequent mischief; and to give him greater confidence, and to banish all fear from his mind, it may be as well to administer ammonia and bark for some days after the accident.

III. Stings of Bees, &c.—The poison apparatus of the common bee consists of glands, and a sting placed at the extremity of the body. The effect of the bite is usually slight, and the pain quickly passes off. In some few instances, however, there have resulted swelling and erysipelas, or suppuration and gangrene, or even death.

In the month of August, 1819, John Trevalli, of Pennsylvania, was stung by a bee in the middle finger of his right hand. He immediately became faint and insensible to surrounding objects; his complexion was livid, his breathing slow, and the perspiration saturated his clothes. At the end of an hour and a half, he was bled, and recovered. On the 21st July, 1820, he was stung in the temple by an humble bee. His wife was present, and gave him some water; but in ten minutes he was dead.—(*American Journal of Medical Sciences*, Vol. 19, p. 265. Philadelphia, 1836.) Two other rapidly fatal cases are noticed in the same journal; as well as two examples of death from the sting of a wasp, and one from the bite of a spider.

Mr. C. Hanbury has recorded a case of death from the sting of a bee (*Medical Times and Gazette*, p. 232. 10th March, 1860); and has also given short abstracts of several examples collected by Dr. Crisp where severe symptoms have resulted from the same injury.—Sir Benjamin Brodie (*Lectures on Pathology and Surgery*, p. 286. *London, 1846*) says he has seen a case in which sloughing of the cellular tissue followed from a leech bite, and

another in which similar mischief followed the sting of a bee. Both the patients died.

And, again, in a communication from Montbard (*La Patrie*, 19th September, 1858) it is stated that a youth, sixteen years of age, was drinking from a bottle, when a wasp, which he had not seen, got into his throat and wounded him. He died suffocated by the swelling, before any assistance could be procured.

According to Messrs. Kirby and Spence (*Introduction to Entomology*, Seventh Edition, p. 76, London, 1856), serious effects are sometimes produced on peculiar constitutions by eating freely of honey, or from partaking of mead—a drink made by fermenting honey and water. These authors state that they knew a lady upon whom such things acted like poison, and they had heard of instances in which death was the consequence. Sometimes when the bees have extracted their sweets from poisonous plants, these injurious results have not been confined to individuals of a particular habit. Thus, according to Dr. Barton, (*American Philosophical Transactions*, vol. 5) there were numerous deaths in the autumn and winter of 1790 from eating honey collected in the neighbourhood of Philadelphia, which, on enquiry, was found to be due to this substance having been extracted from the beautiful but poisonous flowers of the Kalmia latifolia.

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